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A study of the approaches and attitudes of information systems executives to measuring information systems effectiveness

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A STUDY OF THE APPROACHES AND ATTITUDES OF INFORMATION SYSTEMS EXECUTIVES TO MEASURING INFORMATION SYSTEMS EFFECTIVENESS

BY

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USE OF THESIS

The Use of Thesis statement is not included in this version of the thesis.

ABSTRACT

The purpose of the research is to examine the attitudes of IS executives to the current and future importance of some of the approaches to measuring IS efficiency and IS effectiveness in large Australian organisations. The study identified the nature of IS effectiveness approaches along the lines of whether they are business-oriented, IS internal/operational, financial, quantitative or qualitative measures. It also examined whether the structure of the IS management and industry sector had an effect on attitudes towards these measures

The study was initiated with a literature review of some of the measures of IS effectiveness and IS efficiency. The elements which have led to the increased importance in business-oriented measures are namely: the shift in IS management structure from centralisation to decentralisation and eventually to dispersion, and the alignment of IS strategy to business strategy. The research was based on the measurement frameworks which focus on measuring the business performance of IS. They are:

-- Balanced scorecard by Kaplan & Norton (1992)
-- Business value framework by Rubin (1991a, 1991b, 1991c)
-- Enterprise level measurement by Berger (1988)
-- Return on management by Strassmann (1990)

The sample included Australia's top 200 companies by turnover. Such organisations would likely be large enough to be using computer-based products and services. The subjects were the IS managers in organisations.

The research used a mail survey because the sample population was large and dispersed geographically, so uniformity had to be maintained. The major findings of the study are:

- There is currently no significant difference in IS executives' attitudes to the importance placed on IS efficiency and IS effectiveness measures.
- IS internal/operational measures are currently considered more important than business-oriented measures in reflecting the effectiveness of IS.
- IS internal/operational measures are considered more important in the future (the next 5 to 10 years) than business-oriented measures in reflecting the effectiveness of IS.
- IS internal/operational measures are currently considered more important than financial measures in reflecting the effectiveness of IS.
- Qualitative measures are currently considered more important than quantitative measures in reflecting the effectiveness of IS.
- The nature of the industry currently does not affect the degree of importance of the IS effectiveness measures in each industry sector.
- The nature of the IS management structure currently does not affect the degree of importance of IS effectiveness measures.

The study also examined the mediating effects of IS experience and the length of time IS managers have held their current positions on the different categories of IS effectiveness measures.

Declaration

" I certify that this thesis does not incorporate, without acknowledgement, any material previously submitted for a degree or diploma in any institution of higher education and that, to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where due reference is made in the text".

Signature.

Date....25.2.94.....

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Chapter One

INTRODUCTION

Overview

Measuring Information Systems[1] (IS) effectiveness has been a critical issue to IS executives for many years. For example, see Ball & Harris, 1982; Dickson, et al., 1984; Brancheau & Wetherbe, 1987; Amoroso, et al., 1989. Few concrete measures of IS performance exist which reflect the underlying difficulty faced by IS practitioners in determining the value of information systems. The value of information systems has, in the past, been frequently measured in terms of efficiency. Today, however, Information Technology[2] (IT) can be used as a competitive weapon, and not merely used as a tool for processing transactions.

Taking a business approach, the problem of IS effectiveness measurement can be summed up as follows:

> Implicit in what we do in MIS[3] is the belief that information technology has an impact on the bottom line of the business. Surprisingly, we rarely know if this is true. It is very difficult to trace and measure the effects of information technology through a web of intermediate impacts upon enterprise level performance (Crowston & Treacy, 1986, p. 299).

This thesis takes up the challenge of examining IS[4] effectiveness

measures incorporating the use of business factors and examining the attitudes of IS executives towards accepting these business-oriented frameworks to measuring IS effectiveness.

Purpose Of The Study

The purpose of the research is to examine the importance of current approaches in reflecting IS effectiveness in large Australian organisations. The study will identify the nature of these approaches along the lines of whether they are business-oriented, IS internal/operational, financial, qualitative or quantitative measures. In particular, the attitudes of IS executives in these organisations towards accepting business-oriented measurement frameworks will be examined. Business-oriented frameworks for measuring IS effectiveness emerge due to the increasing importance of closely integrating IS with business (Belitsos, 1988; Henry, 1990; Rouse, 1991; Rubin, 1991a, 1991b; Carlson & McNurlin, 1992; Kaplan & Norton, 1992; Wiseman, 1992; Katz, 1993).

Significance Of The Study

The study will determine the current and future importance of the measures used or intended to be used by organisations in reflecting IS effectiveness. The role of IS professionals has changed in recent years as information technology becomes a key to gaining strategic advantage. To IS executives, this research will give them a clearer picture on measurement

focus, the measures available, and the attitudes of other IS executives towards accepting the use of business frameworks to measure IS effectiveness. To senior management (non-IS), the study will provide them with measurement dimensions expressed in business terms i.e., in terms that they can understand.

Research Questions

The study will aim to answer several research questions postulated in order to provide a focus. The questions are divided into main and secondary questions.

Main questions

Do organisations consider the measures of IS effectiveness as important?
The first question concerns whether or not organisations consider only IS effectiveness measures as important, only efficiency measures are important, or both efficiency and effectiveness measures.

What measures are being used by those organisations which measure IS effectiveness?
Some of the measures are single in nature (i.e., they are used individually) such as user perceived effectiveness, user satisfaction or system utilisation as a measure of IS effectiveness. Some organisations, on the other hand, use multiple measures which incorporate measurements of effectiveness in each

of the major functional areas in the organisation.

Are the measures which IS managers perceive as important business-oriented or IS internal / operational?

Business-oriented measures relate change in IS performance and cost-structure to business-critical performance indicators such as profitability, cycle time and product quality resulting from the organisation's external activities with customers, clients and suppliers. IS internal/operational measures are primarily concerned with customer satisfaction, internal processes, and an organisation's innovation and improvement activities. Examples of these are: availability of hardware, software and IS personnel, and timeliness of hardware, software, and IS personnel.

Are the measures which IS managers perceive as important financial or IS internal / operational in nature?

Financially oriented measures stem from traditional financial accounting measures such as return-on-investment, return-on-equity and earnings-per-share. IS internal/operational measures are described in the previous question.

Are the measures which IS managers perceive as important qualitative or quantitative?

Quantitative measures are usually numerically based, such as market share, market growth, timeliness of delivery. Qualitative measures are not numerically based. Examples of these are: improved communications, better decision making, and expanded access to information.

Secondary Questions

Does the structure (centralised or decentralised) of the IS function influence the importance of measures?

In a decentralised structure, IS resources, responsibility and authority are assigned to the business units, i.e there are a number of small IS departments as opposed to one centralised one. A centralised IS function implies that resources are under the responsibility of one IS department.

Does the industry sector influence the importance of measures?

The industry can be divided into three sectors: tertiary, secondary and primary. Examples of companies in the tertiary sector are banking and insurance. Manufacturing is an example in the secondary sector, and mining is in the primary sector.

Organisation Of Thesis

This first chapter presents the purpose of the research, significance of the research, and the research questions. The literature review is divided into three parts and will be presented in chapter two. The first part comprises definitions of efficiency and effectiveness, the second part presents some measures of both and why there is a shift in emphasis from measuring IS efficiency to effectiveness. The third part of the literature review presents reasons for having a business focus towards IS effectiveness measures. The third chapter presents four frameworks of these business-oriented measures

on which this study will be based. The fourth chapter presents the hypotheses tested in this study. Chapter five presents the research method. This chapter describes the sample and subjects of the study, the research design, the pilot testings of the questionnaire, the validity and reliability of instrument, ethical considerations, and data collection. Chapter six presents the data analysis which comprises the demographic data of respondents, the characteristics of the organisation's IS, descriptive statistics of variables, the results of the hypothesis testing, and the mediating effects of some factors on the variables. A discussion of the results and some of the limitations of the study are presented in chapter seven. The last chapter, chapter eight, presents the conclusions of the study which includes some implications of the findings, and some directions for future research.

Chapter Two

LITERATURE REVIEW

The literature review section comprises three parts. The first part compares IS efficiency and IS effectiveness, which includes the definitions of each type. The second part presents a review of some of the current measures of IS efficiency and effectiveness. The third part compares IS effectiveness with business performance and discusses several recent business-related trends such as the shift in focus of IS management and the aligning of IS with business.

IS Efficiency And Effectiveness

There are many interpretations of what effectiveness is. In order to fully understand its meaning, it has often been contrasted with efficiency. This section will present both the definitions of IS efficiency and effectiveness.

The simplest definitions are given by Drucker (1970) who defines efficiency as doing things right and effectiveness as doing the right things.

Efficiency can also be defined as performing a particular task well in relation to given criteria, while effectiveness relates to deciding which tasks should be done (Hirschheim & Smithson, 1986).

Efficiency measures are appropriate at the operational level whereas

effectiveness measures are more suited at the managerial level (Singleton et al., 1988; Bryce, 1992).

Goddard (1989) describes an efficient operation as one which produces the maximum output for a given set of resource inputs or one which uses the minimum inputs to produce a given quantity and quality of service. He describes effectiveness as how well a program or activity is in achieving its established goals or other intended effect.

Dickson et al. (1986) has a similar definition of effectiveness. It is associated with the degree to which organisational objectives are supported by IS. Efficiency on the other hand, is generally associated with cost, accuracy and timeliness of information delivery.

Pava (1983) cited in Belitsos (1988) describes efficiency and effectiveness as follows:

> Efficiency entails perfecting internal operations under conditions of stability. Effectiveness entails bettering the match with one's surrounding environment under conditions of change. (p. 61)

According to Scudder & Kucic (1991), efficiency deals with the timely utilisation of resources in producing a given application, while effectiveness is concerned with the quality and appropriateness of the finished product.

Bryce (1992) illustrates the difference between efficiency and effectiveness as follows:

> Consider a project to excavate a foundation for a building. It is essential that the foundation be placed precisely at the correct location. This is a matter of effectiveness. The method used to create the physical foundation is a matter of efficiency. (p. 70)

In Bryce's view, effectiveness has to be considered first before efficiency. In the context of the above illustration, it is pointless even if the foundation is excavated in an efficient manner if it is placed in the wrong location. He concludes that organisations should first and foremost, focus on effectiveness in order to achieve good results in IS, before placing any emphasis on efficiency.

In contrast with Bryce's view, in earlier studies by Hamilton & Chervany (1981a, 1981b), and Edelman (1981), efficiency has been described as a part of effectiveness. According to Hamilton & Chervany, an effective system is also an efficient system. System effectiveness is described in two views: the goal-centred view and the systems-resource view. Effectiveness in the goal-centred view involves comparing performance to objectives, where objectives are first identified, measures are then developed for these objectives to determine whether they have been met.

The systems-resource view, on the other hand, is described as follows:

> The primary objectives of the MIS function is to develop and operate/maintain information systems...to accomplish the organisation's objectives. Accomplishment of this objective can be evaluated from two perspective ... :
>
> 1. The efficiency with which the MIS development and processes utilize assigned

> resources (staff, machines, materials, money) to provide the information system to the user.
>
> 2. The effectiveness of the users, or the users' organisational unit, using the information system in accomplishing their organisational mission. (Hamilton & Chervany, 1981a, p. 56).

With the systems-resource view, a system is defined as efficient if the resources needed for it to function well are acquired. The second part of this view states that IS is effective if high quality personnel and increased funding are available. The quality of decisions made regarding funding, for instance, are not determined directly, but through the usefulness of the delivered system. This will ultimately have a direct impact on the level of resources to be allocated for the IS function in the future.

Edelman (1981) describes efficiency and effectiveness in a similar way. According to him,

> A useful concept of systems efficiency must take into account *all* of the systems components. This must certainly include the most important and most expensive component, which happens to be the end-user. When that is done...then this distinction [between efficiency and effectiveness] disappears and the *effective system is also efficient*. This broader perspective of system efficiency, on the part of the information professional, is totally essential to survival. (p. 21)

Ameen's (1989) definition of efficiency is concerned with the production of output for a given expenditure of input, whereas effectiveness deals with the quality of production or how well objectives are met. His view on efficiency and

effectiveness is in contrast with those of Hamilton & Chervany (1981a, 1981b), and Edelman (1981). In Ameen's view,

> When efficiency measures are emphasized over effectiveness measures, costs may decrease, and utilisation and throughput may increase, but the quality and timeliness of the resource output will probably decline. The reverse hold true if effectiveness scores are weighted more heavily than efficiency measures. (p. 34)

The two features efficiency and effectiveness though interdependent, are actually contrary. This is confirmed by other studies (Belitsos, 1988; Berger, 1988; Strassmann, 1988).

Carlson & McNurlin (1992) agrees with Ameen (1988). It was determined in their study that IS departments cannot simultaneously minimise cost (i.e. maximise efficiency) and maximise effectiveness because very different organisational structures are required by the two. IS departments which emphasise on efficiency centralise their IS functions, whereas departments which maximise effectiveness report one-half of the functions up the IS hierarchy and the other half to business units.

A more recent definition of IS effectiveness and efficiency is provided by Carlson & McNurlin (1992). Efficiency is concerned with how an organisation performs internally and effectiveness reflects how it performs in the market place. According to them, in today's world, efficiency is synonymous with "quality" and effectiveness with "business performance".

Willcocks (1992) also views IS effectiveness in a business context as the

contribution of IS to organisational performance.

In summary, various definitions of IS efficiency and effectiveness have been presented. Efficiency can be defined as part of effectiveness. On the other hand, efficiency can also be defined as having a contrasting relationship with effectiveness, where both are viewed as trade-offs. These definitions are summarised in table 1 and 2.

Table 1

Definitions of Efficiency

Definitions	References
Doing things right	Drucker (1970)
Performing task well according to given criteria	Hirschheim & Smithson (1986)
Measures appropriate at operational level	Singleton et al. (1988), Bryce (1992)
Measures which produces maximum output for a given input	Goddard (1989)
Associated with cost, accuracy, and timeliness of information delivery	Dickson et al. (1986)
Perfecting internal operations under conditions of stability	Pava (1983)
Timely utilisation of resources	Scudder & Kucic (1991)
Considered only after effectiveness	Bryce (1992)
Part of effectiveness	Hamilton & Chervany (1981a)
Include all systems components and end users (part of effectiveness)	Edelman (1981)
Production of output for a given expenditure of input (trade-off between efficiency and effectiveness)	Ameen (1989)
How an organisation performs internally (contrasting relationship with effectiveness)	Carlson & McNurlin (1992)

Table 2

Definitions of Effectiveness

Definitions	References
Doing the right things	Drucker (1970)
Deciding which tasks to be done	Hirschheim & Smithson (1986)
Measures appropriate at managerial level	Singleton et al. (1988), Bryce (1992)
How well a program/activity achieves established goals	Goddard (1989)
Degree to which organisational objectives are supported by IS	Dickson et al. (1986)
Bettering the match with one's surrounding environment under conditions of change	Pava (1983)
Quality and appropriateness of finished product	Scudder & Kucic (1991)
Considered before efficiency	Bryce (1992)
Goal-centred view and systems- resource view (effectiveness includes efficiency)	Hamilton & Chervany (1981a)
Effectiveness includes efficiency	Edelman (1981)
Quality of production or how well objectives are met (trade-off between efficiency and effectiveness)	Ameen (1989)
How organisation performs in a market place (contrasting relationship with efficiency)	Carlson & McNurlin (1992)
Contribution of IS to organisational performance	Willcocks (1992)

IS Efficiency And Effectiveness Measures

This section reviews some of the measures of IS efficiency and effectiveness currently being used in organisations.

IS Efficiency Measures

It is suggested that in the past, efficiency has been overemphasised at the expense of effectiveness (Hallam & Scriven, 1976; Keen & Scott Morton, 1978; Bjorn-Andersen, 1984; Dickson, et al., 1986; Singleton, et al., 1988). Keen and Scott Morton (1978) cited in Hirschheim and Smithson (1986) gave four reasons why evaluations of IS effectiveness may be problematic and therefore the focus is on measuring IS efficiency:

1. Systems do not have an initial adequate definition of objectives and criteria for "success" and "failure".
2. Evaluation must take into account social (qualitative) aspects, yet most attempts at assessment only include efficiency-oriented and easily quantifiable aspects, i.e., technical objectives.
3. Because of what [effectiveness] evaluation must embrace, it is intrinsically subjective, based on individual value judgments which will differ from one person to the next.
4. Even if initial system objectives could be set, they would be considerably different from the final objectives due to the fact that user requirements evolve and change over time. (p. 21)

Traditional information systems focus mainly on operational and transactional systems. Some of the efficiency measures used are turnaround time, uptime, throughput, jobs processed, and network availability. Such measures have been criticised as meaningless or irrelevant to the users as they are mainly for internal IS use only (Singleton, et al., 1988). He considers users to be most important in measurement dimensions since information systems being measured are designed for them.

Efficiency measures such as those mentioned above are mainly applicable for evaluating "hard" (quantitative) data from operational systems. Therefore, they are said to be inadequate for evaluating many soft (qualitative) benefits derived from IS, such as improved decision making, or added flexibility (Saunders & Jones, 1992).

IS efficiency has also been measured in terms of the activities involved in software development, for example, counting the number of source lines of written code (SLOC). There are problems associated with this measure. SLOC has been said to be a poor measure of programming effort if there is no attempt made to control the language used. The number of lines of code may vary greatly between different languages and there are a variety of definitions as to what lines of code really means (Bergeron & St-Arnaud, 1992).

IS Effectiveness Measures

Early IS effectiveness measures were in terms of user satisfaction and systems usage or utilisation. Other approaches emerged such as cost benefit

analysis, critical success factors and some multiple measures. This section presents the measures together with findings and criticisms.

User Satisfaction and Systems Usage

In earlier studies, the focus of IS effectiveness evaluation was on "users" (Lucas, 1975; Campbell, 1977; Giordano, 1977; Neumann & Segev, 1980). User satisfaction with IS was used as a measure. These studies found user satisfaction to be most useful in assessing IS effectiveness because it provided a link between objectives concerning information provided by the system and objectives concerning improved organisational processes.

System usage or utilisation is another variable which has been frequently used as a measure of IS effectiveness (Ein-Dor & Segev, 1978; King & Rodriguez, 1978). This forms the first shift of emphasis from systems efficiency to effectiveness. The underlying reasoning is that the more a system is used, the more successful or effective it is. Ein-Dor & Segev (1978) supports this approach stating that a system will be used intensively by a manager only if it meets some of the criteria essential for systems success. It is also found that the degree of use is highly correlated with the extent to which the system has been found useful. The extent of use can also be easily measured by system monitors by analysing the usage of different Input/Output channels.

However, this approach was criticised by Ginzberg (1978) who states that the relationship between usage and success/effectiveness is a weak one.

System usage would be a misleading indicator of success if the system is viewed as a service instead of a product designed to help managers perform more effectively. Furthermore, the importance or value of the individual task is ignored by this method of measure. For example, a system may be used infrequently, but it is crucial when in use. Ginzberg (1981), instead supported the use of user perceived effectiveness as an approach to measuring IS effectiveness. User perceived effectiveness uses measures of effectiveness as perceived by users of the system. Some of the measures include user satisfaction and perceived system quality. Another study (Ives et al., 1983) supported the use of both system usage and user perceived effectiveness.

Several studies have tried to correlate usage with satisfaction to determine whether usage plays a key role in determining the effectiveness of an information system. Some reported a positive association between the two (Robey, 1979; Lucas, 1975, 1976). Schewe (1976) found no significant relationship. On the other hand, Srinivasan (1985) found that the two are not always positively associated.

The approach of adopting usage as a measure of IS effectiveness has also been criticised by Symons (1991) for its disregard to the importance of the tasks being carried out. In Symon's view, even though systems may be used infrequently, but on those occasions that they are used, crucial information may be provided. Furthermore, levels of usage does not signify IS effectiveness in cases where utilisation is mandatory or where there is no alternative means of performing the tasks.

Hamilton & Chervany (1981b) considered the focus on users and user

perceptions to be inadequate in measuring IS effectiveness, as user perceptions only represented one viewpoint. In their view, viewpoints from various functional groups involved in IS development and implementation such as internal audit, management, IS personnel and users should be taken into consideration when evaluating IS effectiveness.

Trice & Treacy (1986) cited in Symons (1990) have a similar viewpoint. System usage or utilisation are not the main or the only variable affecting IS effectiveness. It is suggested that "Utilisation be viewed as an intervening variable, i.e. partially determined by information technology variables, and also one of the many variables which ultimately affects [effectiveness] performance." (p. 208)

Cost Benefit Analysis

Cost benefit analysis has been another frequently used measure of IS effectiveness (Hirschheim & Smithson, 1986). This method is most appropriate in situations where costs and benefits are easy to identify and quantify. However, it is argued that benefits are largely qualitative in most IS developments (Connolly, 1988; Symons, 1990; Saunders & Jones, 1992). The benefits of IS are increasingly becoming more strategic or qualitative (e.g. improved decision making, added flexibility, and improved level of customer service). These qualitative benefits are complex and difficult to measure, thus contributing to the main problem of cost benefit analysis.

The determination of costs are generally more straightforward, though

Symons (1990) and Strassmann (1985) disagree. With the current use of IS in support of business strategy, costs spreading over a long time scale for project development are often difficult to determine. For instance, expenses for training and recruitment of skilled staff seem reasonably clear, but how to allocate the costs fairly is less obvious. In practice, there is a frequent failure to include all the true costs.

Critical Success Factors

Information systems effectiveness can be examined in terms of either the organisation's or the system's objectives. Critical success factors (CSFs) is an example of applying such a technique to transfer management thinking into IS performance evaluation. Rockart (1979, p. 85) describes the concept of "Critical Success Factors" as:

> the limited number of areas in which results, if they are satisfactory will ensure successful competitive performance for the organisation. They are the few key areas where 'things must go right' for the business to flourish. If the results in these areas are not adequate, the organisation's efforts for the period will be less than desired.

Hence, CSFs can be summed up as areas of activity in support of the attainment of organisation goals that should receive constant and careful attention from management. Despite problems of bias or over-simplification of objectives (Boynton & Zmud, 1984), the approach has been implemented in a variety of business IS settings to support MIS planning as well as to enhance communication patterns (Munro, 1983).

In recent years, CSFs have also been used to develop specific performance measures and to track performance in a complex information systems environment (Slevin et al., 1991). Critical success factors are identified by top executives using interviews, nominal group technique and consensus. Measurements and performance standards with respect to these factors are then established.

In an earlier study of IS effectiveness measures in the financial services sector (Miller & Doyle, 1987), it was found that some of the measurement factors used in the instrument developed mapped well onto the four critical success factors for the IS function determined by Rockart (1982). This suggests that critical success factors can be used as a tool to establish measures of IS effectiveness.

The CSF approach is based on Etzioni's (1960) goal oriented model used to evaluate organisational effectiveness. The goal oriented model emphasises the achievement of predetermined outcomes as a measure of effectiveness. In general, this model has several problems which may also be applicable to the CSF approach. Firstly, the approach assumes that there is a consensus of the critical success factors. In reality, there are differences in priorities and interests among members of an organisation, and the factors may be ill-defined (Symons, 1991). Secondly, surrogate measurement variables may be weakly linked to outcomes and also the means by which objectives can be achieved are mostly not taken into account (Mingers, 1989).

Multiple Measures

A more useful measure of IS effectiveness is introduced by Miller & Doyle (1987). A total of 38 factors are used, seven of which are found to be most useful as these factors mapped well onto the four critical success factors for the IS function determined by Rockart (1982). The seven factors are: functioning of existing transaction/reporting systems, linkage to strategic processes of the firm, the amount and quality of user involvement, responsiveness to new system needs, the ability to respond to end-user computing needs, the quality of IS staff, and the reliability of services. All these seven factors are used to measure IS effectiveness. For instance, the factor IS quality corresponds to Rockart's IS human resources and user involvement corresponds to Rockart's communications between users and IS staff.

Another evaluative framework consisting of a set of measures to assess the overall effectiveness of IS is introduced by Dickson et al. (1986). These measures are: comparison to standards, a financial risk assessment, an IS managerial assessment, and an organisational IS assessment. The framework lists over 50 factors classified under nine headings. It is argued that the full evaluation of the IS function should be carried out at intervals. It should also be carried out from outside the organisation to ensure objectivity and improve accuracy. This method, however, does not consider or comment on the actual measures to be used. It also does not attempt to pick key factors, as there is no weights applied to the factors (Land, 1986).

Campbell (1977) introduces a set of measures to assess IS effectiveness

in organisations. Each of the major functional areas (finance and accounting, sales and marketing, production and materials management, engineering and production development, personnel and labour, information system, and business planning) of the business organisations would be provided with some measures. For example, in the organisational area of information system, some of the IS effectiveness measures are in terms of reliability, technical performance, perception management, support of the business plan, and critical success factors. In the area of sales and marketing the measures include sales, market share, and demand analysis effectiveness. This framework developed by Campbell was used in a survey of 30 US companies to assess the IS effectiveness of these organisations (Clark, 1992). It was found that most managers only deal with the technical performance aspect of the information system functional area. Measures in other functional areas are not used at all.

IS Effectiveness And Business Performance

IS alignment to business strategy has been an important issue in IS management (Amoroso et al., 1989; Alpar & Ein-Dor, 1991; Caudle, et al., 1991; Niederman et al., 1991; Watson & Brancheau, 1991; Margolis, 1992). As stated by Sullivan-Trainor (1989), the most effective users of IS are those organisations that know how to closely integrate IS with business strategy and culture. The focus of IS initiatives should be more closely towards fulfilling business needs.

Shift In IS Management

With respect to management of IS resources, it is predicted that there will be decentralisation and eventually dispersion of information resources into business units (Fitzgerald, et al., 1990; Clark, 1992). Decentralisation implies that instead of having a central IS department, there are a number of small departments in the business units. Dispersion, on the other hand, is the state where computing resources have been totally absorbed into the functioning business units. In this case there are no IS departments. In a survey of thirty companies in the US, Clark concludes that the size of the central IS function has decreased significantly in the past several years and is predicted to continue to decrease at a faster rate. A majority of the managers who responded encourage the movement of IS resources management towards the direction of decentralisation and dispersion. These conclusions seem to point towards the integration of IS with the business.

Farwell et al. (1992), describes two IS worlds: the new and the old. In the old IS world, it was assumed that (1) information systems would be developed and directly controlled by IS professionals, (2) specialised technical knowledge was needed to develop and use information systems, and (3) the IS professionals would possess all the essential knowledge for designing and implementing effective IS.

In the new IS world, Farwell et al. suggests that there will be changes in the business computing environment with users (1) having more direct control of IS applications, (2) becoming more sophisticated and therefore more demanding of their IS departments and staff, and (3) demanding IS support

and services as opposed to IS products.

This paradigm shift implies that there is a need for IS executives to have an "integrative perspective on corporate computing and the management of corporate information resources" (Farwell, 1992, p. 9) and that to understand and apply IS solution to business problems is the most critical role of IS now and in the future.

Aligning IS With Business

According to Symons (1991), the evaluation of IS effectiveness requires the consideration of two separate but related areas: (1) the linkage of IS strategy to business goals, and (2) the contribution of IS to organisational effectiveness. The linkage of IS strategy to business goals requires not only costs and benefits, but also the formulation of the strategy in terms of constraints and opportunities. In other words, a clear definition of business strategy, an understanding of how to use IT in support of business strategy and the ability to coordinate the two are required for a successful IS strategy. In order to assess the contribution of IS to organisational effectiveness, it is necessary to conceptualise it in terms of implementation issues which include specifications of requirements, assessment of financial costs and benefits, processes of change, and organisational support and conflict management. Therefore, both the linkage of IS to business goals and the consideration of the implementation process relates to the interaction of IT with the business, thus fulfilling the business focus.

Singleton et al. (1988) illustrates how alignment of IS strategy to business strategy can be done in an organisation (in this case, a bank):

> Being a low cost producer is a central part of the bank's -- and thus SPAC's [the bank's IS organisation] --strategy. Considerable progress has been made toward meeting this goal. Their progress is measured by tracking business, not IS variables ... a frequently key measure ... is the overall profit per employee. (p.335)

Carlson & McNurlin (1992) also gave an illustration on linking business measures and IS effectiveness. In a study conducted at Cognitech Services Corporation, some researchers tried to establish a link between organisational performance and IS department effectiveness. A set of measures and data about the IS department and corporate performance were gathered and analysed. For example, the movement of control over IS deliverables into business functions can be used as an organisational predictor of IS effectiveness, whereas the availability of a formal written plan and the level of interaction between the IS and business units during planning can be used as predictors of IS planning effectiveness. The results reflect some correlations between measures of IS effectiveness and three business performance measures: return on equity (ROE), earnings per share (EPS), and revenue/expense. It was concluded that companies with high ROE and EPS have IS departments that emphasise effectiveness rather than efficiency.

As summed up by Katz (1993), IT is extensively dispersed through most organisations. Therefore, to measure only the portion of IT under control of the IS function may give misleading information on the extent of IT in the business and its contribution to the business. In his study of current practices

in measuring the business performance of IT of 175 organisations in North eastern USA, Katz (p. 39) concludes that "the best examples of IS success [effectiveness] appear to be those which have tight performance measurement systems linked directly to important business consequences."

Berger (1988) agrees that organisations should not just measure the performance of specific departments. Management should instead focus on the effectiveness of the enterprise as a whole in achieving its strategic goals.

Several recent studies (Belitsos, 1988; Henry, 1990; Rouse, 1991; Rubin, 1991a, 1991b; Carlson & McNurlin, 1992; Kaplan & Norton, 1992; Wiseman, 1992; Katz, 1993) focus on measuring IS effectiveness in business terms. Four of these will be used as frameworks in this study and will be described in the next chapter.

Chapter Three

THEORETICAL FRAMEWORKS

The research was based on the measurement frameworks which focus on measuring the business performance of IS. They are:

-- Balanced scorecard by Kaplan & Norton (1992)

-- Business value framework by Rubin (1991a, 1991b, 1991c)

-- Enterprise level measurement by Berger (1988)

-- Return on management by Strassmann (1990)

The four frameworks were chosen as they attempt to integrate IS with business, i.e., linking IS internal/operational measures of effectiveness to business performance. IS effectiveness is measured in terms of how much IS contributes to an organisation's earnings and to overall business objectives. These frameworks are developed in response to the inadequacy of previous approaches in measuring the effectiveness of IS in relation to the organisation as a whole. The focus is on measuring the business value of IS which can be derived from a company's external activities with customers, suppliers and financiers. According to Rouse (1991), the business value is usually measured by the change in such indicators such as profitability, market share, market size, etc.

Balanced Scorecard

Kaplan & Norton's (1992) "balanced scorecard" is a model that offers a

balance of financial and operating measures for IS effectiveness. Financial measures reflect what has taken place. The model includes operational measures on customer satisfaction, internal processes, and the organisation's innovation and improvement activities. According to Kaplan & Norton, these non-financial measures are the drivers of future financial performance. The balanced scorecard allows managers to look at the business from four important perspective:

-- customer (How do customers see us?)
-- internal (What must we excel at?)
-- innovation and learning (Can we continue to improve and create value?)
-- financial (How do we look to shareholders?)

Goals from each perspective are specified and appropriate measures are then identified.

With regards to customer perspective, goals are usually derived from general mission statement on customer service which are then translated into specific measures that reflect the factors that really matter to customers.

With internal business perspective, the focus is on those internal operations that enable the organisation to satisfy customer needs. Internal measures identified should stem from the business processes that have the greatest impact on customer satisfaction.

Goals in the innovation and learning perspective are based on the assumption that an organisation should make continual improvements to their existing products and processes and have the ability to introduce entirely

new products with expanded capabilities.

Measures from the financial perspective are used to translate improvements in operations to improvements in sales, market share, reduced operating expenses, or higher asset turnover.

Possible measures for each of these viewpoints which are relevant to IS are:

-- The customer perspective: percent of sales from new products, on-time delivery as defined by the customer, and key customer's ranking of the company (compared to competitors) on quality, delivery time and price performance.
-- The internal business perspective: cycle time, quality, and unit cost of products and services.
-- The financial perspective: quarterly sales growth by business unit, market share, return on equity, and cash flow.
-- The innovation and learning perspective: time to develop new applications, percentage of systems that meet service agreements, staff training rates.

It is claimed by Kaplan & Norton that this approach integrates diverse, complex information in an easy-to-read manner, presenting those measures in each category that management wants emphasised.

Business Value Framework

Rubin (1991a, 1991b, 1991c) introduces the business value framework where IS performance is measured in terms of the business contributions. In his view, the IS organisation must first understand how the company measures its business success, what sort of measures are used and how IS performance links to company performance. The way of getting to business oriented measurement is through three stages:

-- developing and implementing an internal IS measurement program,
-- developing the linkages between applications, projects, and IS investments to the business areas supported, and
-- introducing measures of IS outcomes in business terms.

In the first stage, key measures for assessing technical and software processes are defined in terms of quality, productivity and impact on customer satisfaction. Typical measures include productivity-oriented Input/Output ratios (e.g. function points per team-month), defect densities (defect/size ratio) or failure densities (failure/time period ratio), and technical quality.

In the second stage, the key technical indicators defined in the first stage are linked to business performance. For example, the IS organisation should be able to make assertions about its performance in business terms: "If we show a productivity increase of N% this year, the business will be able to lower product costs by Y% or produce Z new products".

In the third stage, the IS organisation can directly express changes in its performance. Key measures include: business value, cycle time, quality,

profitability, shareholder value, process improvement and yield.

Enterprise-Level Measurement

In the Enterprise-Level measurement by Berger (1988) (also cited in Belitsos, 1988), the business objectives of the enterprise are treated as the objectives of measurement. In order that a real business value can be produced, IT must have a direct impact on company contact with customers, clients and suppliers.

In Berger's view, in today's business environment, IT is not the sole responsibility of one department (the IS department). Other departments such as engineering, sales and customer service may buy and operate their own systems. It is also suggested that when IT's use changes from one supporting another function to being a direct participant in helping to implement business strategy, the entire organisation or enterprise should be the entity measured so that correct measurements can be developed. In other words, when IT is closely integrated with business strategy and operations, measurements have to be based on the degree of satisfaction of a company's business goals.

This approach firstly requires the determination of the enterprise's business objectives and goals. Secondly, it should be decided if IT is needed to accomplish these objectives and goals (i.e. is IT used as a direct participant in helping to implement business strategy?). The next step is to formulate a strategy to support these objectives. Measures used here are based on

business action such as increased market share, new market penetration, and lower product costs. Examples of existing quantitative business measures are:

-- for manufacturing: cost, variance from standards, reject rate.
-- for procurement: price paid for purchases, quality, timeliness of delivery.
-- for manufacturing and procurement: inventory levels (raw material and work-in-progress).
-- for marketing: market share, market growth, new markets.
-- for sales: revenue.
-- for engineering: cost, time to complete new design.
-- for Management Information System: cost, timeliness, accuracy.
-- for staff: cost.
-- for Chief Executive Officer: stockholder equity growth, earnings per share, return on equity.

Return on Management

Strassmann (1990) produced this concept of Return on Management (ROM). It is a measure of performance based on the added value provided by management to an organisation. It is based on the assumption that in the modern organisation, information costs are the costs of managing the enterprise. IT contribution to the business can be assessed by ROM after IT is applied to the organisation. ROM focuses on the most important impact of information technology: on the value-added by management generated in excess of management's total costs. According to Strassmann, understanding how successfully an organisation uses its resources and measuring the

success are prerequisites for analysing the effect of information technologies.

There are several stages to ROM. Total value-added (the difference between net revenues and payments to external suppliers) is firstly established through the financial results of the organisation. A supplier is anyone who invests labour, management and capital to produce a product that the firm includes in its output.

The total value-added divides into elements that distinguish the contribution of capital from the contribution of labour. The contribution of capital is then separated from that of labour by computing the price and the amount of capital employed by the firm. This can be done through the published financial statement where the amount of shareholder equity is multiplied by the risk-adjusted cost of capital. This leaves one with "labour value-added" which is actually the contribution generated by all labour employed by the firm.

All direct operating costs are then subtracted from labour value-added to give "management value-added". It is assumed that management is the only contributor to all labour surplus value through evaluating the competitive environment, developing business strategies, hiring and motivating people, etc. Return on management is then computed by dividing management value-added by the costs of management.

Chapter Four

HYPOTHESES

This study tested seven hypotheses under the following sections: IS efficiency and IS effectiveness measures; IS internal/operational and business-oriented measures; IS internal/operational and financial measures; quantitative and qualitative measures; IS effectiveness measures and IS management structures; and IS effectiveness measures and industry sectors.

IS Efficiency And IS Effectiveness Measures

Determining the value of IS in terms of efficiency measures such as counting the number of source lines of written code (SLOC) has been said to be wrought with problems (Bergeron & St-Arnaud, 1992). Other measures of efficiency such as turnaround time, uptime and throughput have been criticised as meaningless to users as they are mainly for internal IS use only (Singleton, et al., 1988). Furthermore, information systems have evolved from the operational and transactional systems to systems which can be used as competitive weapons. The focus of measurement has shifted from IS efficiency to effectiveness since the mid to late 1970s (Lucas, 1975; Campbell, 1977; Giordano, 1977), where measures such as user satisfaction and systems usage were used. Therefore one would expect that measures on IS performance currently used in organisations will be more effectiveness-oriented than efficiency-oriented. This leads to the first hypothesis,

$H_{0\ 1}$: There is no significant difference between the importance currently placed on IS efficiency and IS effectiveness measures

$H_{A\ 1}$: There is a significant difference between the importance currently placed on IS efficiency and IS effectiveness measures

IS Internal/Operational And Business-Oriented Measures

IS effectiveness measurement frameworks which measure the contribution of IS in business terms have only been developed in recent years. For example, see Berger (1988), Rubin (1991a, 1991b, 1991c), and Kaplan & Norton (1992). Therefore, one would expect organisations to be still focusing on measurements which are IS internal/operational in nature. Hence the second hypothesis is,

$H_{0\ 2}$: There is a no significant difference between the importance currently placed on IS internal/operational and business-oriented measures of IS effectiveness

$H_{A\ 2}$: There is a significant difference between the importance currently placed on IS internal/operational and business-oriented measures of IS effectiveness

Future Importance Of IS Internal and Business-Oriented Measures

As stated by Sullivan-Trainor (1989), the most effective users of IS are those organisations that know how to closely integrate IS with business strategy and culture. IS alignment to business strategy has also been an important issue in IS management. For example, see Amoroso et al. (1989), Caudle et al. (1991), and Niederman et al. (1991). Since there is a need to focus IS initiatives more closely towards fulfilling business needs, one would expect IS executives to consider business-oriented measures to be more important *in the future* (in the next 5-10 years) than the IS internal/operational measurements. Therefore, the third hypothesis is,

$H_{0\ 3}$: There is no significant difference between the importance placed on IS internal/operational and business-oriented measures of IS effectiveness in the future (in the next 5 to 10 years)

$H_{A\ 3}$: There is a significant difference between the importance placed on IS internal/operational and business-oriented measures of IS effectiveness in the future (in the next 5 to 10 years)

IS Internal/Operational And Financial Measures

Campbell (1977) introduces a set of measures to assess IS effectiveness in organisations. Each of the major functional areas (finance and accounting, sales and marketing, production and materials management, engineering and production development, personnel and labour, information system, and

business planning) of the business organisations would be provided with some measures. This framework developed by Campbell was used in a survey of 30 US companies to assess the IS effectiveness of these organisations (Clark, 1992). It was found that most managers only deal with the technical performance aspect of the information system functional area. Measures in other functional areas are not used at all. This would lead one to expect the IS effectiveness measures used in organisations will be more IS internal/operational than financially-oriented. Hence, the third hypothesis is,

$H_{0\ 4}$: There is no significant difference between the importance currently placed on IS internal/operational and financial measures of IS effectiveness.

$H_{A\ 4}$: There is a significant difference between the importance currently placed on IS internal/operational and financial measures of IS effectiveness.

Quantitative And Qualitative Measures

Measures of IS effectiveness which are existing are mostly quantitative (Berger, 1988; Saunders & Jones, 1992). Quantitative measures are usually numerically based, such as market shares, market growth, and timeliness of delivery. Qualitative measures are not numerically based. Examples of these are: improved communications, better decision making, and expanded access to information. Improvements or decreases in performance become easier to judge when dealing with quantifiable figures. In a survey of Fortune 1000

companies' CEOs, it is found that more than three quarters believe that the benefits of IS are quantifiable (Rifkin, 1989). Therefore, it would be expected that IS effectiveness measures used in organisations will be more quantitative than qualitative.

$H_{0\ 5}$: There is no significant difference between the importance currently placed on quantitative and qualitative measures of IS effectiveness.

$H_{A\ 5}$: There is a significant difference between the importance currently placed on quantitative and qualitative measures of IS effectiveness.

IS Effectiveness Measures And The Structure of IS Management

The structure of an organisation's IS management will either be centralised or decentralised. In a decentralised structure, IS resources, responsibility, and authority are assigned to the business units, i.e there are a number of small IS departments as opposed to one centralised one. A centralised IS function implies that resources are under the responsibility of one IS department.

In a survey of thirty companies in the US, Clark (1992) concludes that the size of the central IS function has decreased significantly in the past several years and is predicted to continue to decrease at a faster rate. A majority of the managers who responded encourage the movement of IS

resources management towards the direction of decentralisation and dispersion. These conclusions seem to point towards the integration of IS with the business. The structure of the IS function, therefore, is expected to influence the IS measures used.

$H_{0\ 6}$: There is no significant difference in the importance currently placed on IS effectiveness measures among the different IS management structures

$H_{A\ 6}$: There is a significant difference in the importance currently placed on IS effectiveness measures among the different IS management structures

IS Effectiveness Measures And The Industry Sectors

The industry can be divided into three sectors: tertiary, secondary and primary. The tertiary sector (e.g. banking and insurance), being essentially white collar in nature, are most likely to be very dependent upon computer-based data processing and information systems (Conrath & Mignen, 1990). The secondary sector, manufacturing, also makes heavy use of computing and information systems, though the administration of these businesses is less dependent upon the computer. The primary sector (e.g. mining) is even less dependent upon the computer for administrative purposes. The industry sector, therefore, is expected to influence the IS measures used.

$H_{0\ 7}$: There is no significant difference in the importance currently placed on IS effectiveness measures among the different industry sectors

$H_{A\ 7}$: There is a significant difference in the importance currently placed on IS effectiveness measures among the different industry sectors

Table 3 shows a summary of the hypotheses tested in the study and the variables involved in each hypothesis.

Table 3

Summary of Hypotheses and Variables

Hypotheses	**Variables**
One	IS efficiency measures and IS effectiveness measures
Two	IS internal/operational measures and Business-oriented measures
Three	Future IS internal/operational measures and Future business-oriented measures
Four	IS internal/operational measures and Financial Measures
Five	Quantitative measures and Qualitative measures
Six	IS effectiveness measures and IS management structure
Seven	IS effectiveness measures and Industry sector

Chapter Five

RESEARCH METHOD

This chapter firstly describes the sample and subjects of the study, followed by the research design used which includes the questionnaire design. The pilot testings of the questionnaire are discussed next, followed by the validity and reliability of the questionnaire in terms of construct and content validity and internal consistency. Some ethical considerations and the data collection procedure are then discussed.

Sample And Subjects

The sample included Australia's top 200 companies by turnover. Such organisations would likely be large enough to be using computer-based products and services. Furthermore, these services would probably be of sufficient importance that the organisation ought to be concerned whether or not they are satisfactory.

The sample was selected from the listing of companies in the May database available in the CD-ROM (Australian Stocks Exchange, 1993a). The criterion for selection was: companies with a turnover of more than Australian $80 million. This resulted in a list of 217 companies. In order to get the addresses of these companies, sources such as: "Jobson's year book of Australian companies 1993/1992" by Moffett (1993), "Australia's top 100 listed companies" by Australian Stock Exchange (1993b), and "The business

of who's who of Australia" by Francis (1993) were used. Seventeen of the companies were discarded because either their parent companies were based overseas, or their proper addresses were unobtainable from the above sources. Questionnaires were sent out to the remaining 200 companies used as the sample in the study.

The subjects of the study were the IS managers in these organisations. One manager from each of the 200 organisations was approached. With the emerging use of IT as a direct tool for obtaining competitive advantage, IS becomes more influential in determining the success or otherwise of an organisation. As implied by Avison & Fitzgerald (1991) and Rouse (1991), the responsibility for its direction, planning and control, therefore, must be taken by the most senior management.

Research Design

The research design is the survey. According to Seaman (1987),

> A major advantage of the survey is that data are gathered from a more natural setting. The variables are examined as they are found in the existing social milieu. A large amount of data can also be gathered at a fairly reasonable price. Surveys using the questionnaires are likely to cover a wider geographical area, reach many people, ensure respondents' anonymity, and require less skill to administer. (p. 215)

It was also a mail survey because the sample population is large and dispersed geographically, so uniformity had to be maintained. With mail surveys, the respondent could answer at his/her leisure.

In order to induce responses from potential participants, the most effective method, according to Seaman (1987), seems to be an appeal to the respondents' altruistic nature, by indicating the good that the study may accomplish. For example, letting the respondent know that he or she can help researchers better understand the phenomenon under study may be a considerable inducement to reply. The covering letter, therefore, included an invitation to participate, as well as an explanation of the nature, significance and benefits of the study. Each respondent was also assured that he/she will remain anonymous and the data collected will be kept confidential. A stamped return envelope was mailed together with the letter to each participant.

Data was collected through questionnaires. To ensure accurate and standardised responses, the questionnaires had instructions specifying how they should be filled out. Refer to appendix A for a copy of the questionnaire and the cover letter.

Questionnaire Design

There are three sections in the questionnaire. They are:

1. General background of the organisation's Information Systems,
2. The dimensions of measuring IS efficiency and effectiveness, and

3. Demographic data of each respondent.

The sections are in that order, because it has been suggested that demographic data should be placed in the middle or at the end of the questionnaire (Zikmund, 1988; Davis & Consenza, 1988). These questions may have the possible effect of deterring respondents from answering the rest of the questions if they are placed at the beginning of the questionnaire. In addition, in order to get the respondents involved in the questioning process, information regarding the general background of the organisation's IS are asked at the beginning, because they are simple and general in nature. Once the respondents are involved, they are more inclined to answer the more specific or difficult questions.

There are three items in the first section. The first concerns the industry classification of the organisation. The second item relates to the structure of the management of the organisation's IS department, and the third involves the type of IS (e.g., centralised mainframe with terminals, wide area network, etc.).

The second section has 14 groups of items. Each group comprises of measures of IS performance which fall under the same group. Each measure in a group are derived from the measures mentioned in the literature review section and the frameworks that are outlined in the theoretical framework section. The first four groups relate to IS efficiency measures. The rest (ten groups) are effectiveness measures in the form of IS internal/operational measures, financial, business-oriented , quantitative or qualitative measures. Table 4 shows the references from which the questionnaire items were taken.

Table 4

Origin of Questionnaire Items

Questionnaire Items	Frameworks/ References
IS Efficiency Measures	
Throughput	
Hardware	Ameen (1989)
Software	Ameen (1989)
IS personnel	Ameen (1989)
Utilisation	
Hardware	Ameen (1989)
Software	Ameen (1989)
IS personnel	Ameen (1989)
Cost	
Hardware	Ameen (1989)
Software	Ameen (1989)
IS personnel	Ameen (1989)
Programming	
Lines of programming code delivered	Rubin (1991c)
Function Points	Rubin (1991c)
IS Effectiveness Measures	
Availability	
Hardware	Ameen (1989)
Software	Ameen (1989)
IS personnel	Ameen (1989)
Timeliness	
Hardware	Ameen (1989)
Software	Ameen (1989)
IS personnel	Ameen (1989)
Accuracy of information pertaining to	
Hardware	Ameen (1989)
Software	Ameen (1989)
IS personnel	Ameen (1989)

Table 4

Origin of Questionnaire Items

(continued)

Questionnaire Items	Frameworks/ References
IS Effectiveness Measures (continued)	
Quality	
Overall functional quality rating relating to the extent to which functional requirements are met by IS	Rubin (1991c)
Number of user/customer complaints regarding IS	Hubbard[5] (1992)
Improved service level provided by IS	Katz (1993)
Overall satisfaction of user/customer with IS	Gold[6] (1992)
User/customer perception of ease of use of IS	Gold (1992)
User's perceptions of the degree to which IS is meeting the critical success factors of that part of the organisation	Scudder and Kucic (1991)
Returns	
Return on investment of IS	Katz (1993)
Return on equity attributable to IS	Kaplan & Norton (1992)
Return on assets attributable to IS	Katz (1993)
Return on management (value added by IS)	Strassmann (1990)
IS yield	Rubin (1991a, 1991b)
Overall cost reductions attributable to IS	Katz (1993)
Increased	
Increased earnings per share attributable to IS	Berger (1988)
Increased net income attributable to IS	Kaplan & Norton (1992)
Increased profit margin attributable to IS	Saunders & Jones (1992)
Increased market share attributable to IS	Kaplan & Norton (1992)
Increased sales attributable to IS	Kaplan & Norton (1992)
Comparisons	
Industry comparisons of IS budgets as a percentage of revenue	Saunders & Jones (1992)
Percentage of IS application delivery resources applied to strategic business areas	Gold (1992)
Time	
Time to develop new IS applications	Kaplan & Norton (1992)
Time to adopt new IS methodologies	Kaplan & Norton (1992)

Table 4

Origin of Questionnaire Items

(continued)

Questionnaire Items	Frameworks/ References
IS Effectiveness Measures (continued)	
IS personnel	
Education/training of IS personnel	Gold (1992)
Personnel morale level within IS	Gold (1992)
IS personnel understanding and agreement with strategic directions of the IS	Gold (1992)
IS enables	
Improved communications	Willcocks (1992)
Better decision-making	Saunders & Jones (1992)
Expanded access to information	Miller & Doyle (1987)
Enhanced reporting capabilities	Miller & Doyle (1987)

The third section of the questionnaire has 7 items which made up the demographic data of respondents to be used in the study. They included the age, the current position held and the length of time this position had been held, the amount of experience in the area of IS, the number of employees in the respondent's area of responsibility, the overall rating of the organisation's IS/IT, and the respondent's feeling after completing the questionnaire.

For this study, a 7-point category-numerical scale was preferred to a 5-point or a 3-point scale because it is more sensitive. Sensitivity refers to an

instrument's ability to accurately measure variability in responses. According to Zikmund (1988), the sensitivity of a scale is important when changes in attitudes or other hypothetical constructs are under investigation. In this study, the viewpoints of IS managers in considering the relative importance of different measures of IS effectiveness are being determined. Therefore, a sensitive scale is necessary.

The questionnaire uses both nominal and ordinal measurement scales. Nominal scales are used for demographic data and information on organisational characteristics. The main questions on IS performance measures use category-numeric scale, which is ordinal.

Most of the questions in the questionnaire are closed-ended questions because answers are easier to code and require less time to analyse. Only questions pertaining to the position title in the demographic data, and the additional comments made by the respondents are open-ended. In addition, with 200 questionnaires to be mailed to participants, close-ended questions as a method of data collection provide standardised data.

As suggested by Davis and Consenza (1988), the questions and instructions accompanying mailed questionnaires must be much more succinct than other methods (e.g., interviews) because there is no personal interactions between the researcher and the respondent. Therefore, to ensure the most error-free data possible, the questions should be clearly stated, unambiguous and easily understood. Pilot testing of the questionnaire is a way to help in achieving this goal.

Pilot Testing of Questionnaire

To ensure the validity of the questionnaire, two stages of testing were carried out.

First Testing

The first testing involved four master's degree students (in the area of Information Systems) at Edith Cowan University. Three of them were working full-time in IS. They were asked to complete the questionnaires and comment on the wording of the questions, the scales used, and the general appearance of the questionnaires. In addition, they were also required to record the time taken to complete the questionnaire.

With regard to the wording of the questionnaire, the researcher was looking particularly for clarity and non ambiguity. To improve the wording of the questions, further explanations and examples of terms were provided to those questions which were thought to be unclear during the testing. The use of jargons were also avoided. In addition, some double-barrelled questions were separated into individual questions to improve the credibility of the questionnaire, and to facilitate the interpretations of answers.

The testers also suggested some ways to improve the general layout and appearance of the questionnaire, e.g., by having the spacings between questions increased.

Second Testing

In the second testing, an interview was conducted with an IS manager from a large local company. In the interview, the purpose of the study was explained and some measures of IS effectiveness listed in the questionnaire were also discussed. The IS manager was also asked to fill in the revised questionnaire from the first testing, and to comment on the cover letter, the wording of the questions, and the general layout and appearance of the questionnaire. The questions in general were found to be acceptable and unambiguous.

At the end of the second testing, the IS manager supplied some suggestions on how to provide incentives to encourage people to participate in the study. One of the suggestions was to make the final report available to the participants. Alternatively, in addition to the final report, a comparison of a respondent's response and the average responses of the other participants could also be provided to that particular respondent at the end of the study. Therefore, to encourage participation in the study, at the end of the questionnaire, the respondent was asked if he/she wishes to receive a copy of the final result. Spaces were provided for respondents to supply names and addresses to facilitate mailings of results.

Validity And Reliability

In order to be useful, all measures and scales have to be valid and reliable. According to Seaman (1987),

> ... validity refers to the extent to which various research elements measure what each purports to measure ... Reliability refers to the consistency, stability, accuracy, and dependability with which the scale or instrument measures. (p.317).

Validity

Content validity concerns "the degree to which the scale items represent the domain of the concept under study" (Davis & Consenza, 1988, p.150). According to them, content validity can be ensured through:

1. Conducting an exhaustive search of the literature for all possible items to be included in the scale,
2. Soliciting expert opinions on the inclusion of items,
3. Pretesting the scale on a set of respondents similar to the population to be studied, and
4. Modifying as necessary using the suggestions from (2) and (3).

Content validity of the questionnaire was assumed on the bases that an exhaustive research of the literature for all possible items to be included in the questionnaire had been conducted, expert opinions of the supervisor of the

study and a local IS manager had been solicited, and the questionnaire had been pretested in the form of pilot testing described previously.

With *construct validity*, the validity of concepts (constructs) judges the extent to which the research tool measures the concept or variable that the researcher wants it to measure. In other words, there is evidence for construct validity if the measure behaves the way it is supposed to, in a pattern of intercorrelation with a variety of other variables. According to Davis & Consenza (1988), part of construct validity involves a statistical aspect where the degree to which the measurement scale may be differentiated from other scales purporting to measure maximally different concepts is determined and factor analysis can be used to test this statistical aspect of construct validity.

In this study, the principal components of factor analysis using varimax rotation is applied to the responses for the IS performance measures. Table 5 shows the results of the factor analysis. Only the responses with respect to the current time frame are included in the factor analysis because it is not possible to achieve a varimax convergence for the scores with the future time frame. A cut-off level of 0.30 is chosen so that it is possible to assign all items unambiguously to the first 14 factors (groups) that are used to divide the IS performance measures in the questionnaire. These 14 factors account for 75. 3 % of the total variance of the original measures as explained by each factor. Therefore, there is evidence for construct validity of the items in the questionnaire.

Table 5

Factor Analysis of IS Performance Measures

Questionnaire item	Factor 1:	Factor 2	Factor 3	Factor 4
Throughput	-	-	-	-
Hardware	-	-	0. 335	-
Software	0.754	-	-	-
IS personnel				
Utilisation				
Hardware	-	0. 890	-	-
Software	-	0. 399	-	-
IS personnel	-	-	-	-
Cost				
Hardware	-	-	0. 492	-
Software	-	-	0. 903	-
IS personnel	-	-	0. 778	-
Programming				
Lines of programming code delivered	-	-	-	0. 373
Function Points	-	-	-	0. 944
Percentage of total variance explained by factor	1.873	3.008	4.736	3.210

Note: "-" indicates loading less than 0. 30

Table 5

Factor analysis of IS performance measures
(continued)

Questionnaire item	Factor 5:	Factor 6	Factor 7	Factor 8	Factor 9
Availability					
Hardware	0. 883	-	-	-	-
Software	0. 910	-	-	-	-
IS personnel	-	-	-	-	-
Timeliness					
Hardware	-	0. 832	-	-	-
Software	-	0. 845	-	-	-
IS personnel	-	-	-	-	-
Accuracy of information pertaining to					
Hardware	-	-	0. 932	-	-
Software	-	-	0. 884	-	-
IS personnel	-	-	0. 564	-	-
Quality					
Overall functional quality rating relating to the extent to which functional requirements are met by IS	-	-	-	0. 755	-
Number of user/ customer complaints regarding IS	0. 334	-	-	0. 732	-
Improved service level provided by IS	-	-	-	0. 848	-
Overall satisfaction of user/ customer with IS	-	-	-	0. 889	-
User/customer perception of ease of use of IS	-	-	-	0. 774	-
User's perceptions of the degree to which IS is meeting the critical success factors of that part of the organisation	-	-	-	0. 705	-
Returns					
Return on investment of IS	-	-	-	0. 436	0. 610
Return on equity attributable to IS	-	-	-	-	0. 804
Return on assets attributable to IS	-	-	-	-	0. 884
Return on management (value added by IS)	-	-	-	0. 316	-
IS yield	-	-	-	0. 487	-
Overall cost reductions attributable to IS	-	-	-	-	-
Percentage of total variance explained by factor	5.037	3.626	6.105	13.530	5.549

Note: "-" indicates loading less than 0. 30

Table 5

Factor Analysis of IS Performance Measures
(continued)

Questionnaire item	Factor 10	Factor 11	Factor 12	Factor 13	Factor 14
Returns	-	-	-	-	-
Return on investment of IS	-	-	-	-	-
Return on equity attributable to IS	-	-	-	-	-
Return on assets attributable to IS	-	-	-	-	-
Return on management (value added by IS)	0. 766	0. 310	-	-	-
IS yield	0. 595	0. 688	-	-	-
Overall cost reductions attributable to IS					
Increased					
Increased earnings per share attributable to IS	-	0. 473	-	-	-
Increased net income attributable to IS	-	-	-	-	-
Increased profit margin attributable to IS	-	0. 766	-	-	-
Increased market share attributable to IS	-	0. 945	-	-	-
Increased sales attributable to IS	-	0. 937	-	-	-
Comparisons					
Industry comparisons of IS budgets as a percentage of revenue	-	-	0. 833	0. 383	-
Percentage of IS application delivery resources applied to strategic business areas	-	-	-	0. 327	-
Time					
Time to develop new IS applications	-	-	-	0. 647	-
Time to adopt new IS methodologies	-	-	-	0. 815	-
IS personnel					
Education/training of IS personnel	-	-	-	0. 751	-
Personnel morale level within IS	-	-	-	0. 756	-
IS personnel understanding and agreement with strategic directions of the IS	-	-	-	0. 590	-
IS enables					
Improved communications	-	-	-	0. 337	0. 517
Better decision-making	-	-	-	-	0. 618
Expanded access to information	-	-	-	-	0. 753
Enhanced reporting capabilities	-	-	-	-	0. 936
Percentage of total variance explained by factor	2.984	8.371	2.422	8.584	6.216

Note: "-" indicates loading less than 0. 30

Reliability

Reliability can be examined in terms of internal consistency of the questionnaire responses. Internal consistency is the extent to which all of the subparts of an instrument or scale measure the same characteristics. This can be established through the *Cronbach-Alpha* technique (Davis & Consenza, 1988). It is a technique to test internal consistency, where the mean reliability coefficient estimates for all possible ways of splitting a set of items in half are computed (Cronbach, 1951). Table 6 shows the Cronbach's alpha value for each group of IS performance items in the questionnaire. As can be seen the current, future and combined value of alpha range between 0.503 and 0.930. In general, the typical criterion value for inter-item reliability is 0.80 (Nelson, 1991). When current and future values are observed separately, the current values of 5 items (throughput, utilisation, programming, timeliness and comparisons) are below 0.80. The lack of reliability of these items will affect hypothesis one. Similarly, five of the future values (availability, timeliness, returns, comparisons and IS enables) are below 0.80. Hypothesis three will be affected by this low reliability. The inter-item reliability seems to be low when the values for future and current time frames are viewed separately. However, most combined (current and future) values of items are above 0.80, except for timeliness of hardware, software and personnel which has a value of 0.752.

Table 6

The Cronbach's Alpha Value For Each Group of IS Performance Measure

Questionnaire Items	**Cronbach's Alpha**		
	Current	Future	Combined
Throughput Hardware Software IS personnel	0. 632		
Utilisation Hardware Software IS personnel	0. 568		
Cost Hardware Software IS personnel	0. 822		
Programming Lines of programming code delivered Function Points	0. 655		
Availability Hardware Software IS personnel	0. 704	0. 619	0. 846
Timeliness Hardware Software IS personnel	0. 503	0. 513	0. 752
Accuracy of information pertaining to Hardware Software IS personnel	0. 857	0. 842	0. 930

Table 6

The Cronbach's Alpha Value For Each Group of IS Performance Measure (continued)

Questionnaire Items	Cronbach's Alpha		
	Current	Future	Combined
Quality	0. 944	0. 856	0. 929
Overall functional quality rating relating to the extent to which functional requirements are met by IS			
Number of user/customer complaints regarding IS			
Improved service level provided by IS			
Overall satisfaction of user/customer with IS			
User/customer perception of ease of use of IS			
User's perceptions of the degree to which IS is meeting the critical success factors of that part of the organisation			
Returns	0. 840	0. 788	0. 873
Return on investment of IS			
Return on equity attributable to IS			
Return on assets attributable to IS			
Return on management (value added by IS)			
IS yield			
Overall cost reductions attributable to IS			
Increased	0. 874	0. 839	0. 915
Increased earnings per share attributable to IS			
Increased net income attributable to IS			
Increased profit margin attributable to IS			
Increased market share attributable to IS			
Increased sales attributable to IS			
Comparisons	0. 738	0. 632	0. 873
Industry comparisons of IS budgets as a percentage of revenue			
Percentage of IS application delivery resources applied to strategic business areas			
Time	0. 830	0. 794	0. 846
Time to develop new IS applications			
Time to adopt new IS methodologies			

Table 6

The Cronbach's Alpha Value For Each Group of IS Performance Measure (continued)

Questionnaire Items	Cronbach's Alpha		
	Current	Future	Combined
IS personnel	0. 916	0. 879	0. 837
Education/training of IS personnel			
Personnel morale level within IS			
IS personnel understanding and agreement with strategic directions of the IS			
IS enables			
Improved communications	0. 901	0. 682	0. 827
Better decision-making			
Expanded access to information			
Enhanced reporting capabilities			

Ethical Considerations

The questionnaire and the covering letter sent out to organisations have been approved by Edith Cowan University's Committee for the Conduct of Ethical Research. Complying with the policy, participation in this study was totally voluntary. Anonymity of the respondents was ensured, i.e., names of respondents if disclosed on the questionnaire are only known to the researcher. Each individual response are kept strictly confidential. No names were mentioned in the results of the study and only aggregate data were published. All these considerations were explained in the covering letter addressed to each potential participant.

Data Collection

Initially 200 questionnaires were mailed out. Out of these, three questionnaires were returned due to incorrect addresses. The correct addresses of two of the companies could be obtained from sources other than the initial ones used. Therefore two questionnaires were remailed. Four organisations formally declined to participate in the study due to company policies or that the head offices of the companies had small computer-based Information Systems. As a result, the questionnaire items had little relevance to the small information systems. One IS manager suggested that the questionnaire be sent to one of its subsidiaries. This suggestion was followed. In addition, it was found that two of the companies' parent companies are

based overseas, so there were no Information Systems departments in the Australian branches and they had no IS managers to participate in the study.

One week after the first 200 questionnaires were mailed out, 30 responses were received and 10 more were received in the third and fourth week. After four weeks of the initial mailing, 163 follow-up letters were sent out (see appendix A for a copy of the follow-up letter). Thirty one of the managers who had responded by this time, provided the names of their organisations. Thus follow-up letters were not sent to them. At the end, 45 questionnaires were received, one of them could not be used because more than half of the questionnaire was incomplete. Another was received after the due date for the return of questionnaires.

It has been found that the original mailing and two follow-up mailings result in a return for most people who care to respond at all (Seaman, 1987). Since the questionnaires were mailed, a follow-up mailing would be an effective method of stimulating returns that are not forthcoming. The follow-up mailing occurred four weeks after the initial mailing. Only one follow-up mailing was carried out because of time constraints.

Out of the 45 respondents, 10 did not want the results of the survey to be sent to them, indicating that 77.3 % of the respondents are interested with the outcome of this study. Table 7 shows a summary of the data collection process.

Table 7

Summary of the Data Collection Process

Type	No. of Questionnaires
Total responses used	
Responses Received	45
Unusable responses	1
Late responses	1
Total responses used	43
Total sample	
Questionnaires initially mailed out	200
Questionnaires sent to incorrect addresses	1
Companies declining to participate	4
Parent companies based overseas	2
Additional companies	1
Total sample	194
Response rate = total responses used / total sample	22.2%

In general the response rate for mail surveys are low. According to Babbie (1975), a 50% response rate can be regarded as adequate, 60% as good, and 70% as very good. Parten (1950), on the other hand, expects a lower return, from 10 to 20% for survey response rates. Another Australian study by Watson[7] (1989) which also used the same population as the present study, produces a response rate of 24%, which is close to 22.2% achieved in this study.

Chapter Six

DATA ANALYSIS

The data analysis chapter firstly presents the demographic data of the respondents and the characteristics of the responding organisations' IS/IT. This is then followed by the univariate statistics of the variables used in the hypothesis testing. The results of the hypothesis testing will then be presented. At the end of the chapter, the results of some interesting additional tests will be reported.

Demographic Data

The demographic data comprises each respondent's age, the position currently being held, the length of time this position has been held, the amount IS experience possessed by each respondent, the number of employees in the respondent's area of responsibility and the overall rating of the organisation's IS/IT. Table 8 shows a summary of the demographic data of respondents.

Table 8

Demographic Data of Respondents

	Percentage
Age	
41 years old and above	46. 5 %
31 to 40 years old	41. 9 %
30 years and below	11. 6 %
	100. 0 %
Duration of time current position has been held	
5 years and below	67. 4 %
5 to 10 years	27. 9 %
More than 10 years	4. 7 %
	100. 0 %
Amount of experience in the area of IS	
10 years and below	32. 6 %
10 to 20 years	39. 5 %
More than 20 years	27. 9 %
	100. 0 %
Number of employees in the area of responsibility	
50 and below	88. 4 %
50 to 100	7. 0 %
More than 100	4. 0 %
	100. 0 %
The rating of the organisation's overall IS/IT	
3 (Inadequate)	2. 3 %
4	18. 6 %
5 (Good)	39. 5 %
6	34. 9 %
7 (Very successful)	4. 7 %
	100. 0 %

The percentage of respondents who are below 41 years of age is 53.5%. Because the subjects of the study are IS managers of Australia's largest companies, it would be expected that the number of respondents below 30 years of age will be small (11.6 %). Those with ages between 31 and 40 years old make up 41.9 % of the total respondents.

With regards to the duration of time that the respondents have been holding the current positions of IS managers, most have only held the position for 5 years or less (67.4 %). 27.9% have held them for 5 to 10 years, while only 4.7% have held their current positions for more than 10 years.

The percentage of respondents who have been working in the area of IS for more than 20 years is 27.9 %. The majority (39.5 %) has 10 to 20 years of experience, while those with 10 years and below make up 32.6 %. In other words, more than 67% of the respondents have at least 10 years of experience in IS.

The number of employees under each respondent's area of responsibility are mostly (88.4%) less than fifty. 7% have between 50 to 100 employees under them, and 4.7% have more than 100 employees. Therefore, only a small percentage of respondents have a large IS/IT department in terms of the number of employees.

The respondents' overall rating of their respective organisations' IS/IT can be summarised as follows: 2.3% of the respondents rate their organisation's overall IS/ IT as inadequate; 18.6% give a rating of 4; 39.5% of respondents rate their IS/ IT as good (i.e., a rating of 5), 34.9 % rate their IS/IT

as a 6 and 4.7 rate theirs as very successful (a rating of 7). The scale used for the rating ranges from one to seven, where 1 indicates complete failure and 7 indicates that the IS/IT is very successful. Surprisingly, only a very small percentage of respondents consider their IS/IT as very successful. There are also more than 20% of respondents who rate theirs as less than good (i.e., less than a rating of 5).

Characteristics of the Organisation's IS

The characteristics of the organisation include the industry distribution of the respondents' organisations, the structure of the IS management, and the type of computer-based information systems supporting each organisation.

Industry Profile

The industry distribution of the sample organisations is shown in table 9. The table also shows the industry distribution of Australia's top 200 companies which represent the population of this study. The distribution follows the industry structure of the Australian economy as described by Lipsey et al. (1985), excluding the public sector.

Table 9

Distribution of the Population and Sample by Industry

Industry	Population		Sample	
	Frequency	Percentage	Frequency	Percentage
Manufacturers	66	33.0	12	27.9
Wholesale/Retail trade	36	18.0	6	14.0
Finance, Insurance and Business Services	21	10.5	6	14.0
Agriculture, Forestry, Fishing and Hunting	3	1.5	0	0
Mining	41	20.5	9	20.9
Electricity, Gas and Water	1	0.5	1	2.3
Construction	10	5.0	5	11.9
Transport, Storage and Communication	9	4.5	1	2.3
Entertainment and Personal Service	6	3.0	2	4.7
Publishing	6	3.0	1	2.3
Totals	200	100.0	43	100.0

The largest number of responses are from manufacturing companies (27.9%). Mining comes in second with 20.9% of responses. This is followed by

two categories of industry wholesale/retail trade; and finance, insurance and business services where each category represents 14.0 %. The least number of responses comes from three different industries: electricity, gas and water; transport, storage and communication; and publishing, with each representing 2.3% of the sample.

In order to ensure that respondents are similar in some way to the target population, the industry profile of the respondents was compared with the same profile of the Australia's top 200 organisations. A chi-squared goodness of fit test ($\chi 2 = 6.572$, $p = 0.765$, and $\alpha = 0.05$) shows that there is no significant difference in the frequency distribution of industries represented in the sample and the underlying population.

Structure of IS Management

With respect to the structure of the management of IS departments, most of responding companies have a centralised management structure (58.1%), 37.2% have a decentralised structure and the rest (4.7%) are neither centralised nor decentralised. These are summarised in table 10.

Table 10

Management Structure of the IS Department

Structure	Percentage
Centralised	58. 1 %
Decentralised	37. 2 %
Others*	4. 7 %

* Includes those with no IS departments or those employing external consultants.

Type of Information Systems

There are five categories of information systems stated in the questionnaire. These are: centralised mainframe with terminals; decentralised mini/micro computers; centralised mainframe and decentralised mini/micro computers; wide area network; and local area network. A summary of the distribution of the type of IS can be seen in table 11. Note that an organisation may currently be using more than one type of IS.

Table 11

Types of IS Used in Organisations

Type of IS used	Percentage
Centralised mainframe with terminals	37.2 %
Decentralised mini/micro computers	39.5 %
Centralised mainframe and decentralised mini/micro computers	32.6 %
Wide area network	34.9 %
Local area network	55.8 %

Most organisations (60.5%) have a combination of two or more of these categories, and 39.5% use only one type of IS. The majority (55.8%) of respondents' IS is in the form of local area network.

Descriptive Statistics of Variables

The variables involved in the hypothesis testing include: IS efficiency measures and IS effectiveness measures. The IS effectiveness measures are further divided into five variables namely: IS internal/operational, business-oriented, financial, quantitative and qualitative measures. The respondents were asked to consider how important they feel that each measure is in reflecting IS performance. The original data captured by the questionnaire

uses an importance rating scale of 1 to 7 where 1= irrelevant as a measure of IS performance and 7= very critical as a measure of IS performance.

Since each variable has more than one item or measure in the questionnaire, an average score of the total number of items is computed, for each variable. For example, a mean IS efficiency score is computed from the first four groups of items. Table 12 shows the descriptive statistics for all the items of IS performance measures in the questionnaire. The means for the items range from 2.744 for 'increased net income attributable' to IS to 6.00 for 'timeliness of software'. The standard deviations from the mean range from 0.852 to 1.876 which are relatively low, and therefore, demonstrates that the scores are mostly close to the mean value.

Table 12

Descriptive Statistics of Each IS Performance Measure

Questionnaire Items	Current Mean	Current St. Dev	Future Mean	Future St. Dev
IS Efficiency Measures				
Throughput				
Hardware	4.419	1.332	N/A	N/A
Software	4.442	1.666		
IS personnel	5.163	1.413		
Utilisation				
Hardware	4.721	1.241	N/A	N/A
Software	4.791	1.146		
IS personnel	5.163	1.379		
Cost				
Hardware	5.000	1.091	N/A	N/A
Software	5.279	1.141		
IS personnel	5.116	1.349		
Programming				
Lines of programming code delivered	4.163	1.876	N/A	N/A
Function Points	3.767	1.645		
IS efficiency measures	4.729	0.825		
IS Effectiveness Measures				
Availability				
Hardware	5.791	1.372	6.093	1.428
Software	5.674	1.476	6.000	1.558
IS personnel	4.907	1.716	4.977	1.752
Timeliness				
Hardware	5.512	1.032	5.930	1.078
Software	6.000	0.873	6.488	0.631
IS personnel	5.302	1.372	5.698	1.245
Accuracy of information pertaining to				
Hardware	5.372	1.760	5.558	1.695
Software	5.651	1.602	6.000	1.431
IS personnel	5.000	1.813	5.233	1.674

Table 12

Descriptive Statistics of Each IS Performance Measure

(continued)

Questionnaire Items	Current Mean	Current St. Dev	Future Mean	Future St. Dev
IS Effectiveness Measures (continued)				
Quality				
Overall functional quality rating relating to the extent to which functional requirements are met by IS	5.302	1.372	6.256	0.819
Number of user/customer complaints regarding IS	5.070	1.438	5.581	1.139
Improved service level provided by IS	5.209	1.283	5.837	0.998
Overall satisfaction of user/customer with IS	5.488	1.261	6.070	0.768
User/customer perception of ease of use of IS	5.209	1.206	5.884	1.005
User's perceptions of the degree to which IS is meeting the critical success factors of that part of the organisation	5.163	1.290	6.116	0.823
Returns				
Return on investment of IS	4.930	1.370	5.605	1.237
Return on equity attributable to IS	4.326	1.476	5.070	1.352
Return on assets attributable to IS	4.116	1.546	4.907	1.477
Return on management (value added by IS)	4.721	1.517	5.791	1.206
IS yield	4.488	1.564	5.326	1.476
Overall cost reductions attributable to IS	5.209	0.989	5.558	1.119
Increased				
Increased earnings per share attributable to IS	3.837	1.588	4.512	1.420
Increased net income attributable to IS	2.744	1.529	3.279	1.804
Increased profit margin attributable to IS	4.116	1.483	4.814	1.419
Increased market share attributable to IS	4.256	1.575	5.093	1.601
Increased sales attributable to IS	4.209	1.473	5.163	1.479
Comparisons				
Industry comparisons of IS budgets as a percentage of revenue	4.093	1.509	4.395	1.635
Percentage of IS application delivery resources applied to strategic business areas	4.140	1.441	4.558	1.623
Time				
Time to develop new IS applications	5.047	1.234	5.721	1.221
Time to adopt new IS methodologies	4.256	1.575	5.070	1.454

Table 12

Descriptive Statistics of Each IS Performance Measure

(continued)

Questionnaire Items	Current Mean	Current St. Dev	Future Mean	Future St. Dev
IS Effectiveness Measures (continued)				
IS personnel				
Education/training of IS personnel	4.698	1.389	5.163	1.271
Personnel morale level within IS	4.907	1.324	5.209	1.206
IS personnel understanding and agreement with strategic directions of the IS	4.767	1.411	5.442	1.181
IS enables				
Improved communications	4.814	1.220	5.860	0.804
Better decision-making	5.186	0.852	6.116	0.662
Expanded access to information	5.000	1.047	6.140	0.639
Enhanced reporting capabilities	5.047	0.950	5.814	0.824
Overall IS effectiveness measures	4.863	0.779	5.573	0.717

Table 13 shows how IS effectiveness measures are further divided into five variables: IS internal/operational, business-oriented, financial, quantitative, and qualitative. The mean for each item and the cumulative mean for each variable are also shown[8].

Table 14 shows the division of future importance of IS effectiveness measures into IS internal/operational and business-oriented measures in accordance to the purpose of the study.

Table 13

Nature of Current IS Effectiveness Measures

IS Effectiveness Measures	Mean I/O	Mean B-O	Mean Fin	Mean Qntv	Mean Qltv
Availability					
Hardware	5.791			5.791	
Software	5.674			5.674	
IS personnel	4.907			4.907	
Timeliness					
Hardware	5.512			5.512	
Software	6.000			6.000	
IS personnel	5.302			5.302	
Accuracy of information pertaining to					
Hardware	5.372			5.372	
Software	5.000			5.000	
IS personnel	5.302			5.302	
Quality					
Overall functional quality rating relating to the extent to which functional requirements are met by IS		5.302		5.302	
Number of user/customer complaints regarding IS		5.070		5.070	
Improved service level provided by IS		5.209		5.209	
Overall satisfaction of user/customer with IS		5.488			5.488
User/customer perception of ease of use of IS		5.209			5.209
User's perceptions of the degree to which IS is meeting the critical success factors of that part of the organisation		5.163			5.163
Returns					
Return on investment of IS		4.930	4.930	4.930	
Return on equity attributable to IS		4.326	4.326	4.326	
Return on assets attributable to IS		4.116	4.116	4.116	
Return on management (value added by IS)		4.721	4.721	4.721	
IS yield		4.488	4.488	4.488	
Overall cost reductions attributable to IS		5.209	5.209	5.209	

I/O: IS internal/operational **B-O: Business-oriented** **Fin: Financial**
Qntv: Quantitative **Qltv: Qualitative**

Table 13

Nature of Current IS Effectiveness Measures (continued)

IS Effectiveness Measures	Mean I/O	Mean B-O	Mean Fin	Mean Qntv	Mean Qltv
Increased					
Increased earnings per share attributable to IS		3.837	3.837	3.837	
Increased net income attributable to IS		2.744	2.744	2.744	
Increased profit margin attributable to IS		4.116	4.116	4.116	
Increased market share attributable to IS		4.256	4.256	4.256	
Increased sales attributable to IS		4.209	4.209	4.209	
Comparisons					
Industry comparisons of IS budgets as a percentage of revenue		4.093	4.093	4.093	
Percentage of IS application delivery resources applied to strategic business areas		4.140		4.140	
Time					
Time to develop new IS applications		5.047		5.047	
Time to adopt new IS methodologies		4.256		4.256	
IS personnel					
Education/training of IS personnel		4.698		4.698	
Personnel morale level within IS		4.907			4.907
IS personnel understanding and agreement with strategic directions of the IS		4.767			4.767
IS enables					
Improved communications		4.814			4.814
Better decision-making		5.186			5.186
Expanded access to information		5.000			5.000
Enhanced reporting capabilities		5.047			5.047
Mean	5.468	4.655	4.254	4.785	5.065

I/O: IS internal/operational **B-O: Business-oriented** **Fin: Financial**
Qntv: Quantitative **Qltv: Qualitative**

Table 14

Nature of Future IS Effectiveness Measures

IS Effectiveness Measures	Mean IS internal/ Operational	Mean Business-oriented
Availability		
Hardware	6.093	
Software	6.000	
IS personnel	4.977	
Timeliness		
Hardware	5.930	
Software	6.488	
IS personnel	5.698	
Accuracy of information pertaining to		
Hardware	5.558	
Software	6.000	
IS personnel	5.233	
Quality		
Overall functional quality rating relating to the extent to which functional requirements are met by IS		6.256
Number of user/customer complaints regarding IS		5.581
Improved service level provided by IS		5.837
Overall satisfaction of user/customer with IS		6.070
User/customer perception of ease of use of IS		5.884
User's perceptions of the degree to which IS is meeting the critical success factors of that part of the organisation		6.116
Returns		
Return on investment of IS		5.605
Return on equity attributable to IS		5.070
Return on assets attributable to IS		4.907
Return on management (value added by IS)		5.791
IS yield		5.326
Overall cost reductions attributable to IS		5.558

Table 14

Nature of Future IS Effectiveness Measures (continued)

IS Effectiveness Measures	Mean IS internal/ operational	Mean Business-oriented
Increased		
Increased earnings per share attributable to IS		4.512
Increased net income attributable to IS		3.279
Increased profit margin attributable to IS		4.814
Increased market share attributable to IS		5.093
Increased sales attributable to IS		5.163
Comparisons		
Industry comparisons of IS budgets as a percentage of revenue		4.395
Percentage of IS application delivery resources applied to strategic business areas		4.558
Time		
Time to develop new IS applications		5.721
Time to adopt new IS methodologies		5.070
IS personnel		
Education/training of IS personnel		5.163
Personnel morale level within IS		5.209
IS personnel understanding and agreement with strategic directions of the IS		5.442
IS enables		
Improved communications		5.860
Better decision-making		6.116
Expanded access to information		6.140
Enhanced reporting capabilities		5.814
Mean	5.775	5.370

Table 15 summarises the minimum, maximum, mean and standard deviation of each of the seven variables. The means for the variables ranges from 4.254 to 5.775 and the standard deviations range from 0.684 to 0.971.

Table 15

Summary of the Descriptive Statistics of Variables

Variable	**Mean**	**St. Dev**	**Min**	**Max**
Current time frame				
IS efficiency	4.729	0.825	2.727	6.364
IS effectiveness	4.863	0.779	2.652	6.281
IS internal/operational	5.468	0.828	3.778	7.000
Business-oriented	4.655	0.875	2.036	6.143
Financial	4.254	0.971	1.917	6.167
Quantitative	4.785	0.782	2.607	6.321
Qualitative	5.065	0.930	1.667	6.778
The next 5 to 10 years				
IS internal/operational	5.775	0.749	3.778	7.000
Business-oriented	5.370	0.684	3.464	6.714

Histograms of the variables (see appendix B) show that each follows a normal probability distribution curve. In addition, the sample is representative of the population (see table 9). The variables are continuous in nature. Therefore, parametric tests such as the t-test and the analysis of variance test are used to analyse the data. The t-test is a test of mean differences used on intervally scaled measures. An analysis of variance determines if two or more groups differ on a specific dependent variable. Both are based on the assumption that the sampled population possesses a normal probability distribution.

Hypothesis Testing

The seven hypothesis mentioned previously in chapter four are tested and the results will be shown in this section. The level of alpha[9] used throughout will be 0.05.

Hypothesis One

A t-test was carried out to test the hypothesis shown below:

$H_{0\ 1}$: There is no significant difference between the importance currently placed on IS effectiveness and IS efficiency measures

$H_{A\ 1}$: There is a significant difference between the importance currently placed on IS effectiveness and IS efficiency measures

Table 16 shows the results of the t-test for the first hypothesis. It shows that for a t of 1.269, the probability of the null hypothesis being right is 0.211.

Table 16

Results of t-test for the Importance of IS Effectiveness vs. IS Efficiency Measures

Variable	Mean	St. Dev	P-value	t-value
IS efficiency measures	4. 729	0. 825	0. 211	1. 269
IS effectiveness measures	4. 863	0. 779		

Taking alpha as 0.05, since p(.211) > 0.05, H_0 is accepted. Therefore, there is no significant difference between the importance placed on IS effectiveness and IS efficiency measures. Thus the alternative hypothesis has to be rejected.

Hypothesis Two

A t-test was conducted to test the second hypothesis which is shown below:

$H_{0\ 2}$: There is a no significant difference between the importance currently

placed on IS internal/operational and business-oriented measures of IS effectiveness

H_A 2: There is a significant difference between the importance currently placed on IS internal/operational and business-oriented measures of IS effectiveness

The results of the t-test in table 17 shows that for a t of 6.145, the probability of the null hypothesis being right is 0.000.

Table 17

Results of t-test for the Importance of IS Internal/Operational vs. Business-Oriented Measures

Variable	Mean	St. Dev	P-value	t-value
IS internal/operational measures	5. 468	0. 828	0. 000	6. 145
Business-oriented measures	4. 655	0. 875		

Taking alpha as 0.05, the probability of t being 6.145 is less than 0.05. (i.e., $p<0.05$). Therefore, it is very unlikely that H_0 is correct. Hence H_0 has to be rejected. This implies that there is a difference between the importance placed on IS internal/operational and business-oriented measures of IS effectiveness. The results appear to confirm what has been predicted

previously that IS internal/operational measures are currently considered more important than business-oriented measures.

Hypothesis Three

A t-test was conducted to test the following hypothesis:

$H_{0\ 3}$: There is no significant difference between the importance placed on IS internal/operational and business-oriented measures of IS effectiveness in the future (in the next 5 to 10 years)

$H_{A\ 3}$: There is a significant difference between the importance placed on IS internal/operational and business-oriented measures of IS effectiveness in the future (in the next 5 to 10 years)

Table 18

Results of t-test for the Future Importance of IS Internal/Operational vs. Business-oriented Measures

Variable	Mean	St. Dev	P-value	t-value
IS internal/operational measures (future)	5. 775	0. 749	0. 000	3. 848
Business-oriented measures (future)	5. 370	0. 684		

The result of the t-test in table 18 shows that for a t of 3.848, the probability of the null hypothesis being right is 0.000. Taking alpha as 0.05, the probability of the t being 3.848 is less than 0.05. Therefore, H_0 should be rejected. The means of the variables business-oriented measures and IS internal/operational measures are 5.370 and 5.775 respectively. It shows that the mean for IS internal/operational measures is significantly larger. It implies that IS internal/operational measures will be considered more important in the future (the next 5 to 10 years) than business-oriented measures[10].

Hypothesis Four

The hypotheses tested is:

H_0 4: There is no significant difference between the importance currently placed on IS internal/operational and financial measures of IS effectiveness

H_A 4: There is a significant difference between the importance currently placed on IS internal/operational and financial measures of IS effectiveness

Table 19

Results of t-test for the Importance of IS Internal/Operational vs. Financial measures

Variable	Mean	St. Dev	P-value	t-value
IS internal/operational measures	5. 468	0. 828	0. 000	8. 083
Financial measures	4. 254	0. 971		

The result of the t-test in table 19 shows that for a t of 8.083, the probability of the null hypothesis being right is 0.000. Taking alpha as 0.05, the probability of t being 8.083 is less than 0.05. Therefore, H_0 should be rejected, which implies that there is a significant difference between the importance placed on IS internal/operational and financial measures of IS effectiveness. The results seem to confirm the prediction that IS effectiveness measures which are IS internal/operational are considered more important than financial.

Hypothesis Five

The hypothesis tested is:

$H_{0\ 5}$: There is no significant difference between the importance currently placed on quantitative and qualitative measures of IS effectiveness

$H_{A\,5}$: There is a significant difference between the importance currently placed on quantitative and qualitative measures of IS effectiveness

Table 20

Results of t-test for the Importance of Quantitative vs. Qualitative measures

Variable	Mean	St. Dev	P-value	t-value
Quantitative measures	4. 785	0. 782	0. 004	3. 090
Qualitative measures	5. 065	0. 930		

The result of the t-test in table 20 shows that for a t of 3.090, the probability of the null hypothesis being right is 0.004. Taking alpha as 0.05, the probability of t being 3.090 is less than 0.05. Therefore, H_0 has to be rejected, implying that there is a significant difference between the importance placed on quantitative and qualitative measures of IS effectiveness. Previously, it was predicted that quantitative measures would be considered more important than qualitative measures. However, the means of quantitative and qualitative measures are 4.785 and 5.065 respectively indicating that the mean score for qualitative measures is significantly larger. Therefore, the results do not support the earlier prediction. Instead, IS effectiveness measures are more qualitative than quantitative.

Hypothesis Six

The statistical test used for hypothesis six is the analysis of variance as it involves more than two factors in the variables, i.e., there are three types of IS structures: centralised, decentralised and others. The hypothesis tested is:

$H_{0\ 6}$: There is no significant difference in the importance currently placed on IS effectiveness measures among the different IS management structures

$H_{A\ 6}$: There is a significant difference in the importance currently placed on IS effectiveness measures among the different IS management structures

The results of the analysis of variance yield an F ratio of 2.375, and a probability value of 0.106 (see table 21). At alpha = 0.05, since the probability of H_0 being true is greater than alpha, H_0 should be accepted. This implies that there is no difference in the means for IS effectiveness measures with respect to different IS management structures. Looking at Tukey's[11] multiple comparisons test results in table 22, the probabilities are all greater than 0.05, therefore, every pairwise comparison is not significant. The results imply that the previous prediction that there is a significant difference in the importance placed on IS effectiveness measures among the different IS management structures does not appear to be true.

Table 21

One Way ANOVA of IS Effectiveness Measures by IS Management Structure

Source	SS	df	MS	F	P
IS management structure	2.707	2	1.353	2.375	0.106
Error	22.798	40	0.570		
Total	25.505	42			

Table 22

Tukey's Matrix of Pairwise Comparison Probabilities of IS Effectiveness Measures by IS Management Structure

	Centralised	Decentralised	Other
Centralised	1.000		
Decentralised	0.136	1.000	
Other	0.416	0.909	1.000

Hypothesis Seven

The hypothesis tested is:

H_0 7: There is no significant difference in the importance currently placed on IS effectiveness measures among the different industry sectors

H_A 7: There is a significant difference in the importance currently placed on IS effectiveness measures among the different industry sectors

In this case, the 10 groups in the industry, according to the examples provided by Conrath & Mignen (1990) can be divided into three sectors: primary, secondary and tertiary as shown in table 23.

Table 23

Industry Distribution of Sample

Industry	Sectors	Sample Frequency
Mining	Primary	9
Electricity, Gas and Water	Primary	1
Agriculture, Forestry, Fishing and Hunting	Primary	0
Manufacturers	Secondary	12
Construction	Secondary	5
Wholesale/Retail trade	Tertiary	6
Finance, Insurance, and Business Services	Tertiary	6
Transport, Storage and Communications	Tertiary	1
Entertainment and Personal Service	Tertiary	2
Publishing	Tertiary	1
Total		43

An analysis of variance is conducted on the sample which has been dividedby the three industry sectors (see table 24). The F-ratio obtained is 0.098 and the probability is 0.907. Taking alpha as 0.05, since the probability is greater than alpha, the null hypothesis has to be accepted, i.e., there is no difference in the means for IS effectiveness measures used with respect to different industry sectors.

Table 24

One Way ANOVA of IS Effectiveness Measures by Industry Sector

Source	SS	df	MS	F	P
Industry sector	0.124	2	0.062	0.098	0.907
Error	25.381	40	0.635		
Total	25.505	42			

Looking at Tukey's pairwise comparison probabilities shown in table 25, none of the values are less than 0.05, therefore they are not significant.

Table 25

Tukey's Matrix of Pairwise Comparison Probabilities of IS Effectiveness Measures by Industry Sector

	Primary	Secondary	Tertiary
Primary	1. 000		
Secondary	0. 952	1. 000	
Tertiary	0. 899	0. 985	1. 000

Looking at Tukey's multiple comparisons test results in table 25, the probabilities are all greater than 0.05, therefore, every pairwise comparison is not significant. Previously, it was predicted that there is a significant difference in the importance placed on IS effectiveness measures among the different industry sectors. The results, however, show otherwise.

A summary of the results of the hypotheses testing is shown in table 26.

Table 26

Summary of the Results of Hypothesis Testing

Hypotheses	Results
H_0 1: There is no significant difference between the importance currently placed on IS effectiveness and IS efficiency measures	The null hypothesis is accepted
H_A 1: There is a significant difference between the importance currently placed on IS effectiveness and IS efficiency measures	
H_0 2: There is a no significant difference between the importance currently placed on IS internal/ operational and business-oriented measures of IS effectiveness.	The null hypothesis is rejected
H_A 2: There is a significant difference between the importance currently placed on IS internal/ operational and business-oriented measures IS effectiveness.	
H_0 3: There is no significant difference between the importance placed on IS internal/operational and business-oriented measures of IS effectiveness in the future (in the next 5 to 10 years).	The null hypothesis is rejected
H_A 3: There is a significant difference between the importance placed on IS internal/operational and business-oriented measures of IS effectiveness in the future (in the next 5 to 10 years).	
H_0 4: There is no significant difference between the importance currently placed on IS internal/ operational and financial-oriented measures of IS effectiveness.	The null hypothesis is rejected
H_A 4: There is a significant difference between the importance currently placed on IS internal/ operational and financial-oriented measures of IS effectiveness.	

Table 26

Summary of the results of hypothesis testing

(continued)

Hypotheses	Results
H_0 5: There is no significant difference between the importance currently placed on quantitative and qualitative measures of IS effectiveness. H_A 5: There is a significant difference between the importance currently placed on quantitative and qualitative measures of IS effectiveness.	The null hypothesis is rejected
H_0 6: There is no significant difference in the importance currently placed on IS effectiveness measures among the different IS management structures H_A 6: There is a significant difference in the importance currently placed on IS effectiveness measures among the different IS management structures	The null hypothesis is accepted
H_0 7: There is no significant difference in the importance currently placed on IS effectiveness measures among the different industry sectors H_A 7: There is a significant difference in the importance currently placed on IS effectiveness measures among the different industry sectors	The null hypothesis is accepted

Mediating Effects on Variables

Some of the additional tests are conducted in order to facilitate more in-depth discussion into the topics that are of major interest in this study. The mediating effects of factors such as IS management structure, IS experience and IS position will be examined on the variables. Both the ANOVA and t-tests are performed on each variable. The ANOVA is performed to examine the mediating effects of a factor on each of the five variables, whereas t-tests are performed to examine the differences between the importance of two variables (e.g., IS efficiency and IS effectiveness) in each category of a factor (e.g., those with less than 10 years of IS experience). In most cases, only significant results are shown, unless a comparison between significant and insignificant results becomes essential.

The Effects of IS Management Structure

An additional test is firstly performed to examine the effect of the nature of IS management structure on the perceived importance of IS efficiency and IS effectiveness measures. This is motivated by the assertion that systems departments cannot simultaneously emphasise on IS efficiency and IS effectiveness because the two require very different IS management structures. Carlson & McNurlin (1992) found that companies that emphasise on IS efficiency tend to have centralised IS management structures. The results of the test will be shown next.

IS Efficiency and IS Effectiveness Measures

An analysis of variance of IS *efficiency* scores grouped by the structure of each respondent's IS management is conducted. See table 27.

Table 27

One Way ANOVA of IS Efficiency Scores by IS Management Structure

Source	SS	df	MS	F	P
IS management structure	4.160	2	2.080	3.409	0.043
Error	24.410	40	0.610		
Total	28.570	42			

An F-ratio of 3.409 and a probability of 0.043 are obtained. P is less than 0.05, which implies that there are differences in the means among the groups of IS management structure. Tukey's matrix of pairwise comparison probabilities are shown in table 28.

Table 28

Tukey's Matrix of Pairwise Comparison Probabilities of IS Efficiency Measures by IS Management Structure

	Centralised	Decentralised	Other
Centralised	1.000		
Decentralised	0.037	1.000	
Other	0.620	0.983	1.000

It can be seen that the pairwise probability between centralised and decentralised structures is less than 0.05. Therefore, there is a significant difference in the means of IS efficiency scores between the two groups. To confirm this finding, an analysis of variance between the two scores was conducted, yielding an F-ratio of 6.531 and a probability of 0.015. It can be concluded that the structures of respondents' IS management affect the IS efficiency scores. The mean IS efficiency score for those with centralised structures (4.993) is higher than the mean score for those with decentralised IS structures (4.353).

Next, an analysis of variance of IS *effectiveness* scores grouped by the structure of each respondent's IS management was also conducted[12]. The F-ratio obtained is 2.375 and the probability is 0.106 (see table 29). Tukey's matrix of pairwise comparison probabilities are shown in table 30. Since p is greater than 0.05, and none of the probabilities in the table are significant, it

can be concluded that there is no difference in the IS effectiveness scores among the different groups of IS structures.

Table 29

One Way ANOVA of IS Effectiveness Scores by IS Management Structure

Source	SS	df	MS	F	P
IS management structure	2.707	2	1.353	2.375	0.106
Error	22.798	40	0.570		
Total	25.505	42			

Table 30

Tukey's Matrix of Pairwise Comparison Probabilities of IS Effectiveness Measures by IS Management Structure

	Centralised	Decentralised	Other
Centralised	1.000		
Decentralised	0.136	1.000	
Other	0.416	0.909	1.000

Other IS Effectiveness Measures

t-test were performed on the various IS effectiveness scores for those with centralised and decentralised IS management structures. The results are shown on table 31.

Table 31

The Effects of IS Management Structure on the Importance of IS Effectiveness Measures

IS Management Structure	Mean	St. Dev	P-value	t-value
Centralised				
IS internal/operational (current)	5.613	0.787	0.000	4.116
Business-oriented (current)	4.886	0.690		
Decentralised				
IS internal/operational (current)	5.271	0.905	0.001	3.982
Business-oriented (current)	4.370	1.062		
Centralised				
IS internal/operational (future)	5.907	0.776	0.016	2.587
Business-oriented (future)	5.531	0.602		
Decentralised				
IS internal/operational (future)	5.633	0.492	0.037	2.296
Business-oriented (future)	5.252	0.672		
Centralised				
IS internal/operational (current)	5.613	0.787	0.000	5.682
Financial (current)	4.490	0.852		
Decentralised				
IS internal/operational (current)	5.271	0.905	0.000	4.941
Financial (current)	3.980	1.083		
Centralised				
Quantitative (current)	4.987	0.625	0.004	3.222
Qualitative (current)	5.298	0.685		
Decentralised				
Quantitative (current)	4.545	0.924	0.338	0.989
Qualitative (current)	4.723	1.203		

As can be seen, there is a significant difference between the mean scores of IS internal/operational and business-oriented measures (currently) for both centralised and decentralised structures. IS internal/operational score is significantly higher for both.

With regards to the future importance of IS internal/operational and business-oriented measures, for both structures, IS internal/operational scores are higher than business-oriented scores.

It can be seen that IS internal/operational scores are significantly higher than financial scores for both centralised and decentralised structures.

IS management structure, therefore, does not affect the current importance placed on IS internal/operational and business-oriented measures, and IS internal/operational and financial measures. IS management structure also does not affect the future importance of IS internal/operational and business-oriented measures.

The qualitative score for respondents with centralised IS management structures is significantly higher than the quantitative scores. On the other hand, there are no significant differences in the quantitative and qualitative scores for those with decentralised structures. IS management structure, therefore, affects the importance currently placed on quantitive and qualitative measures.

The Effects of IS Experience Possessed by Respondents

The effects of the amount of IS experience possessed by respondents on variables are found to be of interest because it would be assumed that respondents who have more experience in IS would possess more management skills. Therefore, they would be expected to consider business-oriented measures to be more important in the future than IS internal/operational measures, or at the very least as important as IS internal/operational measures.

IS Efficiency and IS Effectiveness Measures

An ANOVA was performed on IS efficiency scores to examine the effects of IS experience on this variable (see table 32).

Table 32

One Way ANOVA of IS Efficiency Scores by IS Experience

Source	SS	df	MS	F	P
IS Experience	5.143	2	2.571	4.390	0.019
Error	23.427	40	0.586		
Total	28.570	42			

An F-ratio of 4.390 and a probability of 0.019 are obtained. P is less than 0.05, which implies that there are differences in the means among the groups of IS experience. Tukey's matrix of pairwise comparison probabilities are shown in table 33. It can be seen that there is a significant difference between the efficiency score of those who have between 10 to 20 years of IS experience and those with more than 20 years. The mean IS efficiency score for the former is significantly higher (see table 36), i.e., IS efficiency measures are considered more important by those with 10 to 20 years of experience than those with more than 20 years. Therefore, the amount of IS experience possessed affect how the respondents rate the importance of IS efficiency measures.

Table 33

Tukey's Matrix of Pairwise Comparison Probabilities of IS Efficiency Measures by IS Experience

	10 years and below	10 to 20 years	More than 20 years
10 years and below	1.000		
10 to 20 years	0.166	1.000	
More than 20 years	0.539	0.017	1.000

Next, an analysis of variance of IS *effectiveness* scores grouped by IS experience possessed by each respondent was also conducted.

Table 34

One Way ANOVA of IS Effectiveness Scores by IS Experience

Source	SS	df	MS	F	P
IS management structure	2.054	2	1.027	1.752	0.187
Error	23.451	40	0.586		
Total	25.505	42			

Table 35

Tukey's Matrix of Pairwise Comparison Probabilities of IS Effectiveness Measures by IS Experience

	Centralised	Decentralised	Other
Centralised	1.000		
Decentralised	0.437	1.000	
Other	0.827	0.183	1.000

The F-ratio obtained is 1.752 and the probability is 0.187 (see table 34). Tukey's matrix of pairwise comparison probabilities are shown in table 35. Since p is greater than 0.05, and none of the probabilities in the table are significant, it can be concluded that there is no difference in the IS effectiveness scores among the different groups of IS experience.

t-tests were also performed on IS efficiency and IS effectiveness scores to examine the effects of IS experience on these two variables. The results are shown on table 36. It shows that there are no significant differences in both IS efficiency and effectiveness scores for all groups of IS experience.

Table 36

The Effects of IS Experience on IS Efficiency and IS Effectiveness Measures

Years of IS Experience	Mean	St. Dev	P-value	t-value
10 years and below				
IS efficiency	4.617	0.638	0.344	0.982
IS effectiveness	4.777	0.446		
10 to 20 years				
IS efficiency	5.129	0.786	0.958	0.054
IS effectiveness	5.119	0.722		
More than 20 years				
IS efficiency	4.297	0.864	0.151	1.545
IS effectiveness	4.599	1.068		

Other IS Effectiveness Measures

t-tests were performed on the different categories of IS effectiveness variable. The results (see table 37) show that for each category of IS experience, the IS internal/operational scores are significantly higher than business-oriented scores. This seems to show that the amount of IS experience possessed by respondents does not affect how they currently perceive the importance of the two measures.

With regards to IS internal/operational scores and business-oriented scores (for the future time frame), the results show that two probability values are significant (i.e., $P < 0.05$). Those with 10 years and below of IS experience have a higher score for IS internal/operational measures than business-oriented measures. Similarly, those with 10 to 20 years of experience in IS also have a higher IS internal/operational scores than business-oriented scores. On the other hand, those with more than 20 years of IS experience seem to place equal importance on the two measures. Therefore, the amount of IS experience possessed by respondents affect the future importance of IS internal/operational and business-oriented measures.

The results also show that for all groups of IS experience, the IS internal/operational scores are significantly higher than financial measures. This shows that the amount of IS experience possessed by respondents does not affect the importance placed on the two measures.

Table 37

The Effects of IS Experience on the Importance of IS Effectiveness Measures

Years of IS Experience	Mean	St. Dev	P-value	t-value
10 years and below				
IS Internal/operational (current)	5.310	0.583	0.007	3.220
Business-oriented (current)	4.594	0.573		
10 to 20 years				
IS Internal/operational (current)	5.726	0.825	0.002	3.809
Business-oriented (current)	4.911	0.815		
More than 20 years				
IS Internal/operational (current)	5.287	1.028	0.006	3.372
Business-oriented (current)	4.367	1.172		
10 years and below				
IS Internal/operational (future)	5.595	0.605	0.034	2.372
Business-oriented (future)	5.079	0.738		
10 to 20 years				
IS Internal/operational (future)	6.026	0.645	0.006	3.171
Business-oriented (future)	5.680	0.439		
More than 20 years				
IS Internal/operational (future)	5.630	0.971	0.166	1.482
Business-oriented (future)	5.268	0.770		
10 years and below				
IS Internal/operational (current)	5.310	0.583	0.002	3.888
Financial (current)	4.244	0.802		
10 to 20 years				
IS Internal/operational (current)	5.726	0.825	0.000	5.322
Financial (current)	4.436	0.976		
More than 20 years				
IS Internal/operational (current)	5.287	1.028	0.001	4.505
Financial (current)	4.008	1.158		
10 years and below				
Quantitative (current)	4.689	0.526	0.076	1.925
Qualitative (current)	5.016	0.532		
10 to 20 years				
Quantitative (current)	5.054	0.720	0.040	2.238
Qualitative (current)	5.275	0.818		
More than 20 years	4.513	1.024	0.199	1.368
Quantitative (current)	4.823	1.362		
Qualitative (current)				

With regards to quantitative and qualitative measures, the results show that for those with 10 years and below of IS experience and those with more than 20 years of IS experience, there are no significant differences in the importance placed on quantitative and qualitative measures. However, for those with between 10 and 20 years of IS experience, there is a significant difference in the quantitative and qualitative scores. The qualitative score is higher. The amount of IS experience seems to have an effect on the importance placed on these two measures.

An ANOVA was also performed on the future business-oriented scores to examine the effects on IS experience on this variable (see table 38). An F-ratio of 3.538 and a probability of 0.038 are obtained. P is less than 0.05, which implies that there are differences in the means among the groups of IS experience. Tukey's matrix of pairwise comparison probabilities are shown in table 39. It can be seen that there is a significant difference between the business-oriented score of those who have less than 10 years of IS experience and those with between 10 and 20 years. The mean business-oriented score for the latter is significantly higher (see table 37), i.e., business-oriented measures are considered more important by those with 10 to 20 years of experience than those with less than 10 years. Therefore, the amount of IS experience possessed affect how the respondents rate the importance of business-oriented measures.

Table 38

One Way ANOVA of Future Business-Oriented Measures by IS Experience

Source	SS	df	MS	F	P
IS Experience	2.951	2	1.475	3.538	0.038
Error	16.679	40	0.417		
Total	19.630	42			

Table 39

Tukey's Matrix of Pairwise Comparison Probabilities of Future Business-Oriented Measures by IS Experience

	10 years and below	10 to 20 years	More than 20 years
10 years and below	1.000		
10 to 20 years	0.036	1.000	
More than 20 years	0.740	0.219	1.000

The Effects of the Length of Time the Current Position Has Been Held

Additional tests are performed to examine the effects of the length of time the current position of IS manager has been held on the variables. The effects of time as IS manager are of interest because it would be assumed that those who have been IS managers for a longer time would possess more developed management skills. Therefore, they would consider business-oriented measures as more important than IS internal/operational measures.

IS Efficiency and IS Effectiveness Measures

To examine the effects of the length of time respondents have been IS managers on IS efficiency and IS effectiveness scores, t-tests were performed on the two variables. The results (see table 40) show for all groups, there are no significant differences in the importance placed on IS efficiency and IS effectiveness scores. Therefore, the length of time the respondents have held their current positions as managers does not affect the two measures.

Table 40

The Effects of the Length of Time Current Position Has Been Held on IS Efficiency and IS Effectiveness Measures

Length of Time	Mean	St. Dev	P-value	t-value
5 years and below				
IS efficiency	4.871	0.673	0.483	0.711
IS effectiveness	4.962	0.644		
5 to 10 years				
IS efficiency	4.486	1.102	0.514	0.675
IS effectiveness	4.630	1.082		
More than 10 years				
IS efficiency	4.140	0.707	0.269	2.227
IS effectiveness	4.820	0.269		

Other IS Effectiveness Measures

t-tests are performed on the different types of IS effectiveness variable to see the effects of the length of time current positions of IS managers have been held. The results (see table 41) show that those who have been IS managers for 5 years and below and those with 5 to 10 years show significant differences in the way they rate the current importance of the IS internal/operational and business-oriented measures. IS internal/operational scores are significantly higher than business-oriented measures. However, there are no differences in the importance placed on the two measures by those who have been IS managers for more than 10 years. Therefore, the length of time the respondents have held their current positions as IS managers affect the how they perceive the two measures.

Table 41

The Effects of the Length of Time Current Position Has Been Held on the Importance of IS Effectiveness Measures

Length of Time	Mean	St. Dev	P-value	t-value
5 years and below				
IS internal/operational (current)	5.513	0.697	0.000	4.754
Business-oriented (current)	4.772	0.754		
5 to 10 years				
IS internal/operational (current)	5.499	1.055	0.000	5.265
Business-oriented (current)	4.337	1.149		
More than 10 years				
IS internal/operational (current)	4.610	1.174	0.809	0.310
Business-oriented (current)	4.875	0.021		
5 years and below				
Internal/operational (future)	5.820	0.620	0.000	3.464
Business-oriented (future)	5.366	0.699		
5 to 10 years				
Internal/operational (future)	5.823	0.891	0.020	2.726
Business-oriented (future)	5.404	0.731		
More than 10 years				
Internal/operational (future)	4.835	1.492	0.748	0.417
Business-oriented (future)	5.215	0.205		
5 years and below				
IS internal/operational (current)	5.513	0.697	0.000	6.154
Financial (current)	4.310	0.976		
5 to 10 years				
IS internal/operational (current)	5.499	1.055	0.000	6.994
Financial (current)	4.111	1.061		
More than 10 years				
IS internal/operational (current)	4.610	1.174	0.824	0.284
Financial (current)	4.290	0.410		
5 years and below				
Quantitative (current)	4.871	0.684	0.003	3.213
Qualitative (current)	5.207	0.713		
5 to 10 years				
Quantitative (current)	4.624	1.040	0.877	0.158
Qualitative (current)	4.603	1.260		
More than 10 years	4.500	0.156	0.164	3.788
Quantitative (current)	5.775	0.629		
Qualitative (current)				

With regards to the future importance of IS internal/operational and business-oriented measures, the results show that two probability values are significant (i.e., $P < 0.05$). For the two groups (5 years and below and between 5 and 10 years) the IS internal/operational scores are significantly higher than business-oriented scores. On the other hand, for those who have been managers for more than 10 years, neither of the measure is higher than the other. They seem to place equal importance on both types of measures. Therefore, the length of time the respondents have been managers seems to affect how the measures of IS internal/operational and business-oriented measures are rated.

The tests results also show that there are significant differences in the IS internal/operational and financial measures for those who have been IS managers for 5 years and below and for those with between 5 to 10 years of experience. The IS internal/operational scores are significantly higher. On the other hand, there are no differences between the two scores for those who have been IS managers for more than 10 years.

In addition, there are no significant differences in quantitative and qualitative scores for those who have been IS managers for 5 to 10 years and for those with more than 10 years. However, there is a significant difference between the quantitative and qualitative scores for those who have been IS managers for less than 5 years. The qualitative score is significantly higher.

The discussion of these results will be presented in the next chapter.

Chapter Seven

DISCUSSION

This chapter firstly presents a review of the research purpose and aims, followed by the limitations of the study and a summary of the findings. A discussion of the findings of this study will be presented next under the following sections: IS efficiency versus IS effectiveness measures, IS internal/operational versus business-oriented measures, IS internal/ operational versus financial measures, and quantitative versus qualitative measures in line with the hypotheses. The findings of additional analyses measuring the effects of IS management structure, IS experience possessed by respondents and the amount of time the respondents have held their current positions as IS managers are also discussed.

Review Of Research Purpose And Approaches

The purpose of the research was to examine the degree of importance of some approaches in reflecting IS effectiveness in large Australian organisations. This was determined through the nature of these approaches along the lines of whether they are business-oriented, IS internal/operational, financial, quantitative or qualitative measures. The attitudes of IS executives in these organisations towards accepting business-oriented measurement frameworks in the future (in the next 5 to 10 years) were also examined. Business-oriented frameworks for measuring IS effectiveness have emerged

due to the increasing importance of closely integrating IS with business. The focus of IS initiatives appears to be shifting towards fulfilling business needs.

The study was initiated with a literature review of some of the measures of IS effectiveness and IS efficiency. The elements which led to the increased importance in business-oriented measures are namely: the shift in IS management structure from centralisation to decentralisation and eventually to dispersion, and the alignment of IS strategy to business strategy. Some recent business-oriented frameworks for measuring the effectiveness of information systems were examined next. These are: the Balanced Scorecard by Kaplan & Norton (1992), Business Value framework by Rubin (1991), Enterprise Level measurement by Berger (1988), and Return on Management by Strassmann (1990). This was followed by the formulation of the hypotheses. The instrument through which data was collected was the questionnaire. The items included in this questionnaire were determined from the literature which was reviewed in chapter two, as well as from some recent business-oriented frameworks stated in chapter three. After the questionnaire had been tested, two hundred of them (one to each organisation) were mailed to the top organisations in Australia listed on the Australian Stock Exchange. The data from the returned questionnaires were analysed in accordance with the hypotheses stated in chapter four. Several additional tests which would facilitate in the discussion were also conducted on the data. Presently, some of the limitations of the study will be discussed.

Limitations Of The Study

There are several limitations to the study. Firstly, this kind of study does not appear to have been conducted by other researchers before. Therefore, established instruments for measuring variables used by previous studies was not available which means that it is also not possible to make comparisons with other studies in terms of the questionnaire items as well as the results of the study.

Secondly, the research design used is the survey. A major weakness of a survey design is that it only collects self reports, i.e., recall may be selective or the respondent may not be willing to express attitudes or beliefs on sensitive topics. The inconsistency in the personality, perceptions and values of the participants can lead to inaccuracy.

In addition, the response rate of 22% may be regarded to be low. Some of the reasons which could explain this are:

1. The population, being Australia's top 200 companies, is probably frequently approached by other researchers and could be feeling fed up of being continuously approached to participate in surveys. Furthermore, some companies may not have a policy of responding to surveys altogether.

2. The questionnaire which comprises of 10 pages may be thought to be too

long, and hence one look at it will deter some potential participants from responding. They may feel that it will take too much time to fill up the questionnaire.

3. The questionnaires are mailed to the headquarters of the top 200 companies. Surprisingly, some of the computer information systems are small and hence they are not relevant to the study. Two companies actually wrote in to suggest that the questionnaire be mailed to their subsidiaries, instead of the headquarters/parent companies because their information systems were very small.

There are other limitations to the study such as the low internal reliability of some of the responses when the responses for the current and future importance of IS measures are observed separately. Some of the Cronbach-Alpha values for internal consistency were found to be lower than the typical value. The low reliability of these items may affect the results of hypothesis testings. In addition, the construct validity of the items in the questionnaire for the future time frame may be low as no convergence was achieved after many iterations of the principal components of factor analysis. Therefore, this low validity may also be another limiting factor of the study. In some cases of analysis testings, the sample sizes may be too small for the findings to be significant which may be another limitation.

The way the variables have been conceived may also be another limitation. There are many ways found in the literature to categorise variables into groups such as IS internal/operational and business-oriented, qualitative

and quantitative. There are no agreements on specific definitions of IS effectiveness measures.

Before discussing the findings in detail, a summary of the findings will be presented.

Summary Of The Findings

The findings are summarised in diagram forms shown in figures 1 to 4.

Figure 1

Attitude of IS Executives Towards the Importance of IS Measures

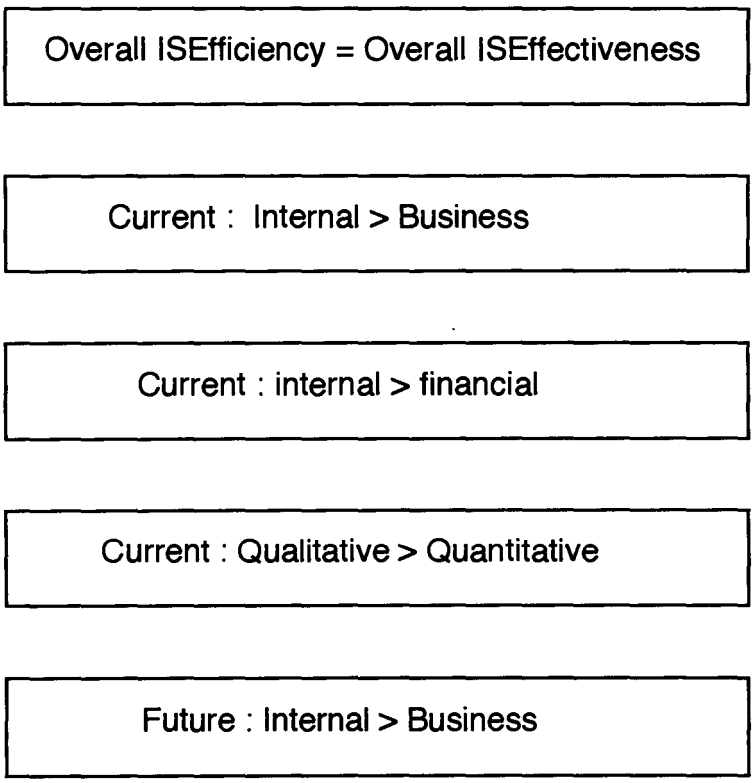


Figure 2

The Effects of IS Management Structure on IS Measures

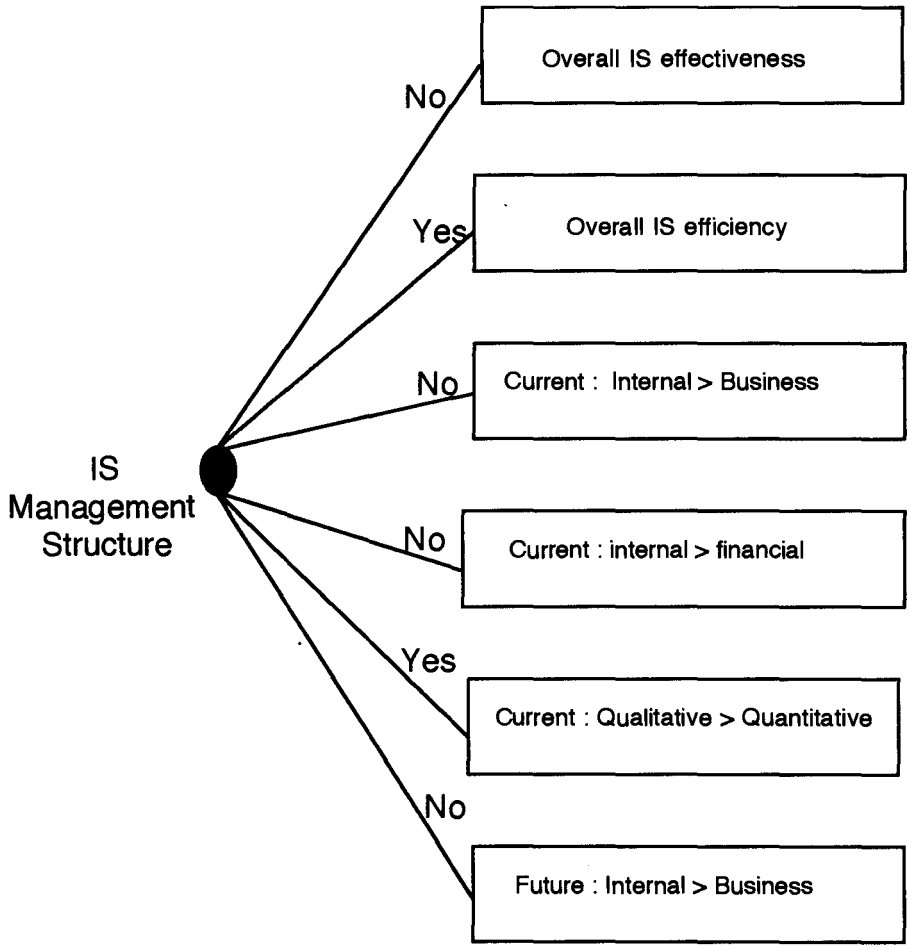
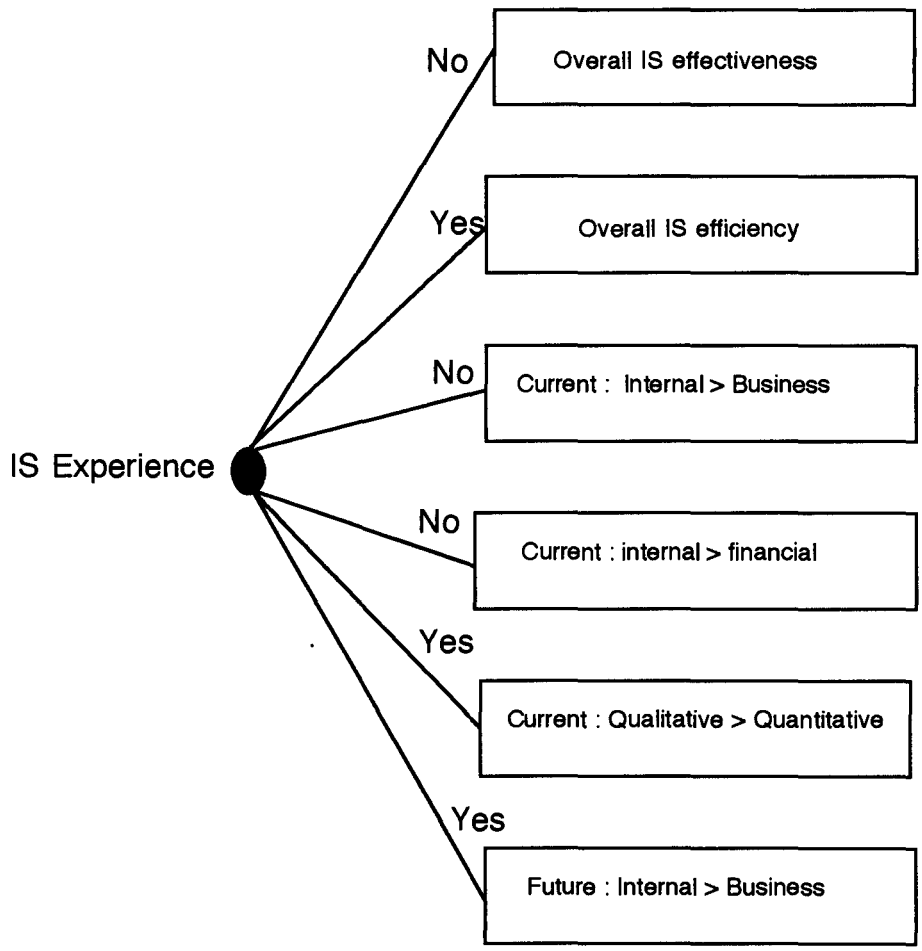
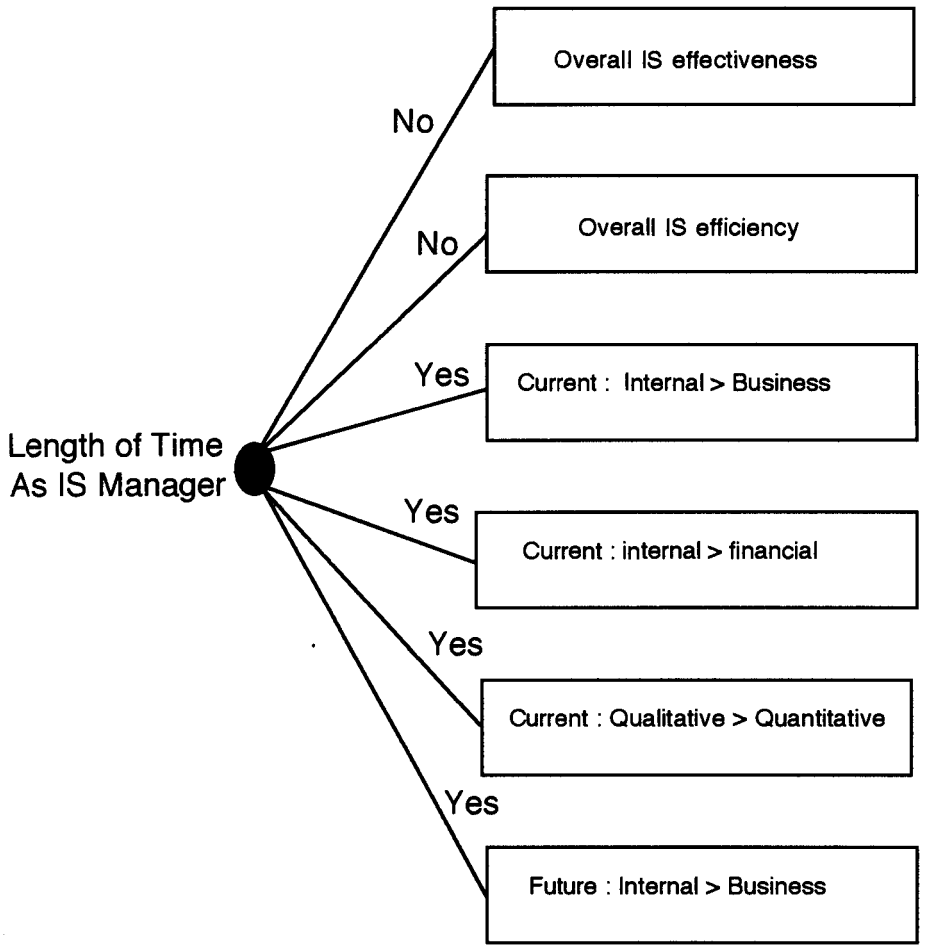


Figure 3

The Effects of IS Experience on IS Measures



The Effects of Time As IS Manager on IS Measures



The major findings are:

IS Managers' Attitudes

- There is no significant difference in the current importance placed on the overall IS efficiency and IS effectiveness measures.

- IS internal/operational measures are currently considered more important than business-oriented measures in reflecting the effectiveness of IS.

- IS internal/operational measures are considered more important in the future (the next 5 to 10 years) than business-oriented measures in reflecting the effectiveness of IS.

- IS internal/operational measures are currently considered more important than financial measures in reflecting the effectiveness of IS.

- Qualitative measures are currently considered more important than quantitative measures in reflecting the effectiveness of IS.

The Effect of Industry Sector

- The nature of the industry does not currently affect the degree of importance of the overall IS effectiveness measure.

The Effect of IS Management Structure

- The nature of the IS management structure does not currently affect the degree of importance of the overall IS effectiveness measure.

- The nature of the IS management structure currently has a mediating effect on the importance placed on the overall IS efficiency measure.

- The nature of the IS management structure does not have a mediating effect on the current importance placed on IS internal/operational and business-oriented measures, and IS internal/operational and financial measures.

- The nature of the IS management structure does not have a mediating effect on the future importance placed on IS internal/operational and business-oriented measures.

- Qualitative measures are currently considered to be more important than quantitative measures in organisations with a centralised IS management structure.

The Effect of IS Experience

- IS experience does not have a mediating effect on the current importance of the overall IS effectiveness measure.

- IS experience has a mediating effect on the current importance of the overall IS efficiency measure.

- IS experience does not have a mediating effect on the current importance of IS internal/operational and business-oriented measures.

- IS experience has a mediating effect on the future importance placed on IS internal/operational and business-oriented measures.

- IS experience does not have a mediating effect on the current importance of IS internal/operational and financial measures.

- IS experience has a mediating effect on the current importance of quantitative and qualitative measures.

The Effect of Time as IS Manager

- The length of time that respondents have been IS managers does not have a mediating effect on the current importance placed on the overall IS efficiency and IS effectiveness measures.

- The length of time that respondents have been IS managers has a mediating effect on the current importance placed on IS internal/ operational and business-oriented measures, IS internal/operational and

financial measures, and quantitative and qualitative measures.

- The length of time that respondents have been IS managers has a mediating effect on the importance placed on IS internal/operational and business-oriented measures in the future (the next 5 to 10 years).

The following discussion looks at the findings of the study in relation to the literature.

The Importance of IS Efficiency Versus IS Effectiveness

The results of the first hypothesis testing show that there is no difference in the importance placed on IS effectiveness measures and IS efficiency measures in reflecting IS performance. This is contrary to what was initially predicted. It was expected that IS effectiveness measures will be considered more important than IS efficiency measures. Obviously, measures of IS efficiency are still considered as important as IS effectiveness measures.

Measures are often computed in terms of costs, such as cost per employee, cost per customer , or cost per transaction. These are efficiency measures and they are widely used because they are easy to compute and they are useful in a relative sense, by tracking them over time. Improvements in costs overtime are seen as a positive step towards an increase in the value derived from IS. This may explain why IS efficiency measures are still considered important by IS managers.

Bjorn-Andersen (1984) remarked that efficiency criteria has often been over-emphasised at the expense of effectiveness. Crane (1990) agrees that many organisations are still measuring things that are easily assessed such as number of lines of code written, cost per CPU cycle or hours worked per project. In other words, many of the organisation studied may not have progressed from this point.

This phenomenon could also be explained in connection to Bryce's (1992) study. In Bryce's study of Japanese and American companies, it was discovered that American companies were concentrating more on efficiency whereas Japanese companies emphasised on effectiveness. The difference in focus was due to cultural differences between the two countries. American companies emphasised on efficiency through putting concentration on programming technology and tools. In Bryce's view, effectiveness deals with management issues whereas efficiency does not. Most managers in the US graduated from the ranks of programming and do not entirely understand or appreciate management issues, hence they focus on efficiency. Australian IS managers may also be similar in cultural backgrounds to US managers. In addition, they may also have graduated from the ranks of programming and hence are more technically inclined. This could be an area for further research.

Current Importance of IS Internal/Operational And Business-Oriented Measures Of IS Effectiveness

The results of the hypothesis testing follows the previous prediction that IS internal/operational measures are considered more important *currently* than business-oriented measures.

IS effectiveness measurement frameworks which measure the contribution of IS in business terms have only been developed in recent years. For example, see Berger (1988), Rubin (1991a, 1991b, 1991c), and Kaplan & Norton (1992). Therefore, one would expect organisations to be still focusing on measurements which are IS internal/operational in nature.

From the ranking of IS effectiveness measures, it shows that the top five and those ranked 7th and 8th respectively are IS internal/operational in nature. This probably reflects why the hypothesis that current measures of information systems effectiveness are more IS internal/operational than business-oriented is accepted. See table 42 for a list of the top 20 IS effectiveness scores.

Table 42

The Top Twenty IS Effectiveness Measures for the Current Time Frame

Item	Mean	St. Dev
1. Timeliness of software	6.000	0.873
2. Availability of hardware	5.791	1.372
3. Availability of software	5.674	1.476
4. Accuracy of information pertaining to software	5.651	1.602
5. Timeliness (response time) of hardware	5.512	1.032
6. Overall satisfaction of user/customer with IS	5.488	1.261
7. Accuracy of information pertaining to hardware	5.372	1.760
8. Timeliness of IS personnel	5.302	1.372
9. Overall functional quality relating to the extent to which user functional requirements are met by IS	5.302	1.372
10. Overall cost reductions attributable to IS	5.209	0.989
11. User/customer perception of ease of use of IS	5.209	1.206
12. Improved service level provided by IS	5.209	1.283
13. Better decision making	5.186	0.852
14. Users' perceptions of the degree to which IS is meeting the critical success factors of that part of the organisation	5.163	1.290
15. Number of user/customer complaints regarding IS	5.070	1.438
16. Enhanced reporting capabilities	5.047	0.950
17. Time to develop new IS applications	5.047	1.234
18. Expanded access to information	5.000	1.047
19. Accuracy of information pertaining to user personnel	5.000	1.813
20. Return on investment of IS	4.930	1.370

Future Importance of IS Internal/Operational And Business-Oriented Measures Of IS Effectiveness

When IS managers were asked of their perceptions on the future (in the next 5 to 10 years) importance of IS internal/operational and business-oriented measures, they feel that IS internal/operational measures will still be more important than business-oriented measures. The opposite of this was initially predicted.

According to a study of Chief Information Officers (CIOs) and Chief Executive Officers (CEOs) in 2500 companies in the US and Canada conducted by Plewa & Lyman (1992), the CEO has been found to consistently focus on such outside factors as market share, customer satisfaction, and the buyer of the organisation's products or services, whereas the CIO measures the success of IS performance by IS internal/operational measures. When asked to report the department's progress, CIOs usually discuss the following: system and network uptime, reports delivered on time, number of errors, number of abends, and control over expenses. This demonstrates that CIOs are still focussing on the department rather than the entire organisation.

Perhaps, another reason that business-oriented measures are not considered as important as IS internal/operational measures, is that measurement techniques of IS benefits in organisations has not changed even though their information systems are becoming more sophisticated (Willcocks, 1992). The same measurement techniques could still be used for all systems, regardless of the different objectives and different types of benefits that are derived from the systems. Vowler (1990) cited in Willcocks (1992) found that

66% of the organisations surveyed were poor at measuring the contribution of IS to the business.

In a study conducted by Clark (1992), a number of IS executives interviewed felt that the assessment of systems at the enterprise level was not useful because of the difficulties involved. Even though many of the IS executives know the importance of business-oriented measures, very few actually know how to solve this problem or have devised a way to measure the contribution of IS in business terms. In addition, it is suggested that the most enduring benefits from systems are human based, and these are considered much more difficult to measure than operational benefits like improved response times (Connolly, 1988). Therefore, the human based measure of benefits may not be as widely used as the operational measures. So, this may be another reason why business-oriented measures are considered less important now and in the future than IS internal/operational measures, as found in this study.

Perhaps the most important reason of all is that to expect IS personnel to measure IS effectiveness in business terms would be equivalent to expecting IS staff to all be talented business people working as equal partners with the business units to design systems that will benefit the company. According to Waldman (1992), this is a very unrealistic expectation of the real world where generally about 80 percent of IS staff are technology-oriented and only 20 percent are business-oriented. Therefore, IS should be judged by how effectively it builds the system that the business side has decided on and not evaluated on the benefits that its system return to the corporation. Waldman asserts that it is difficult to assign a hard dollar figure to the value of

systems because the value they contribute is indirect. The best course to take is to concentrate on work output, quality and operational efficiency through such metrics as function points, user surveys, and comparison with original cost estimates. This is in line with the findings of the study, in that IS effectiveness measures which are IS internal/operational in nature are still regarded as more important than business-oriented measures.

The Importance of IS Internal/Operational Versus Financial Measures Of IS Effectiveness

As predicted, it was found that IS internal/operational measures of IS effectiveness are considered more important than financial-oriented measures. CEOs would consider financial measures to be more important and would widely monitor IS through these measures as supported by Rifkin (1989), and Kauffman & Weill (1989). However, the subjects of the study were IS managers, which therefore, made the conclusion different. Saunders & Jones' (1992) study of IS executives showed that even though financial measures of performance were widely employed by organisations, these measures of financial contribution were perceived to have only moderate evaluation value and often considered to be of limited use. The finding of this study seems to support the same conclusion.

Clark (1992), in his study of the use of IS effectiveness measures in organisations found that most managers only deal with the technical/operational performance aspect of the information systems. Other measures such as financial measures are not used at all. Faster cycle levels

and time saved on specific tasks can be measured. However, it is very difficult to establish a clear evidence of a return on investment (Belitsos, 1988). Because of this difficulty, such financial measures may be considered less important by respondents.

The Importance of IS Quantitative Versus Qualitative Measures of IS Effectiveness

Previously, it was predicted that quantitative measures will be regarded as more important than qualitative measures in reflecting IS effectiveness, but the findings show that the qualitative effectiveness measures were considered to be more important by IS managers than the quantitative ones. Initially, it was expected that measures of IS effectiveness which are existing are mostly quantitative (Berger, 1988; Saunders & Jones, 1992). Improvements or decreases in performance become easier to judge when dealing with quantifiable figures. In a survey of Fortune 1000 companies' CEOs, it is found that more than three quarters believe that the benefits of IS are quantifiable (Rifkin, 1989). Therefore, it would be expected that IS effectiveness measures used in organisations will be more quantitative than qualitative.

The study's finding, however, shows the opposite. The reason for this could be that a great portion of the quantitative measures are financial in nature. From findings in this study, it can be seen that financial measures to IS managers are not as important as IS internal/operational measures. In addition, Saunders & Jones (1992) came to the same conclusion that financial

measures were found to be of limited use by IS executives. Therefore, it is possible that the financial portion of quantitative measures results in the mean score being low compared to the qualitative mean score.

Kaplan (1986) , Willcocks (1992) and many others agree that many of the benefits of IS (such as quality, flexibility, responsiveness, functional integration, etc.) are intangible. Therefore, the measures for these benefits have to be qualitative because they are difficult to be quantified. According to Willcocks (1992), many IS/IT investments are justified by faith alone. Notional figures are used instead of employing rigorous methods to calculate the benefits of investments in IT/IS.

One IS manager in an insurance company has been quoted to say that there is no formal procedure for addressing the value of IS. It is considered a subjective process (Sullivan-Trainor, 1991). Companies in the financial services sector which were surveyed found that it was extremely difficult to measure the contribution made by IT to their business performance (Yap & Walsham, 1986). When asked how IT investments were justified, one company said that in larger projects, they usually went by 'gut feel' (Financial Times, 13 June 1989).

In a study conducted by Katz (1993) on measuring business value most senior executives believe that the benefits of IS expenditures are quantifiable and measurable in some way. However, these executives tend to offer only vague, general guidelines when asked what quantifiable measures are being used. This may be another reason why qualitative measures are considered more important than quantitative measures.

The most significant reason could perhaps be as suggested by Singleton et al., (1988) that measures of IS effectiveness tend to become more qualitative and less quantitative as the focus moves from operational to managerial to strategic concerns. In this study, the subjects are IS managers, and the evaluation of IS effectiveness is viewed from the managerial perspective. Therefore, qualitative measures should be more important than quantitative measures. The finding of this study supports this conclusion.

The Effects Of The Structure Of IS Management

In a survey of thirty companies in the US, Clark (1992) concludes that the size of the central IS function has decreased significantly in the past several years and is predicted to continue to decrease at a faster rate. A majority of the managers who responded encouraged the movement of IS resources management towards the direction of decentralisation and dispersion. These conclusions seem to point towards the integration of IS with the business. The structure of the IS function, therefore, is expected to influence the IS measures used. The results of this study does not show this. There are no differences in the degree of importance placed on IS effectiveness measures in the different groups of structures. IS management structure seem to affect efficiency measures but not effectiveness measures.

The majority of respondents (58.1%) have a centralised management structure, while 37.2% have a decentralised structure. In the study described by Carlson & McNurlin (1992), IS departments that maximise effectiveness

have a 50-50 split in their management structure. It is suggested that departments which are even 25% decentralised, and 75% centralised could still be shown that they are maximising effectiveness. Accordingly, the finding of this study should show a difference in IS effectiveness scores between those having centralised and decentralised management structures. The reason for the difference in findings for this study and other previous studies is unclear. This could be another area for further research.

It was found that the mean IS efficiency score for those with centralised structures is significantly higher than the mean score for those with decentralised IS structures. This seems to support Carlson & McNurlin's (1992) conclusion that systems departments that emphasise on IS efficiency tend to have centralised IS management structures.

The results of the t-tests do show a difference in how the IS managers rate the importance of quantitative and qualitative measures with respect to IS management structure. Those with centralised IS management structure rate qualitative measures as more important than quantitative measures. On the other hand, those with decentralised structures show no differences in how they rate the importance of the two measures.

It would be assumed that if there were to be any differences between the two structures, those with decentralised structures would be expected to rate qualitative measures as more important than quantitative measures, instead of those with centralised structures. In a decentralised structure, IS resources, responsibility and authority are assigned to the business units, i.e there are a number of small IS departments as opposed to one centralised one,

whereas a centralised IS function implies that resources are under the responsibility of one IS department. With the influence of business units, the measures would incorporate business-oriented measures and hence would tend to be more qualitative. A further research into this area is necessary.

The Effects Of Industry Sector

The industry can be divided into three sectors: tertiary, secondary and primary. The tertiary sector (e.g. banking and insurance), being essentially white collar in nature, are most likely to be very dependent upon computer-based data processing and information systems (Conrath & Mignen, 1990). The secondary sector, manufacturing, also makes heavy use of computing and information systems, though the administration of these businesses is less dependent upon the computer. The primary sector (e.g. mining) is even less dependent upon the computer for administrative purposes. The industry sector, therefore, is expected to influence the IS measures used. The finding of this study, however, shows that there are no significant differences in the degree of importance placed on IS effectiveness measures in the different industry sectors. A further research in this area is needed.

The Effects Of IS Experience Possessed By Respondents

The results show that there is no mediating effect of IS experience on the current importance of the overall IS effectiveness measures.

However, from the ANOVA performed on IS efficiency measures, it seemed that the amount of IS experience affect how the IS managers rate the importance of these measures. Those with between 10 and 20 years of experience rate IS efficiency measures as more important than those with more than 20 years of experience. It was assumed earlier that IS managers who have more IS experience will have more developed management skills to be able to consider IS efficiency measures to be less important at the managerial level. Singleton, et al., (1988) suggests that IS efficiency is key at the operational level, and less emphasis is placed on it as effectiveness of the organisation and management becomes essential at the managerial level. This finding of the study seem to be in agreement with Singleton's assertion. On the other hand, there are no differences in importance of IS efficiency scores between those with less than 10 years of experience and those with more than 20 years of IS experience.

The ANOVA results show that there is a significant difference in how the future importance of business-oriented measures are perceived by IS managers. Those with 10 years and below of IS experience rate business-oriented measures as significantly less important than those with between 10 to 20 years of IS experience. This finding seems to support the assumption that those IS managers who have more experience in IS would have developed more management skills in order to consider business-oriented measures to be

more important as compared to those with less experience in IS. However, there are no differences found in how business-oriented measures are rated between those who have 10 years and less of IS experience and those who have more than 20 years of experience, when differences between the two are actually expected. Both categories of IS managers rate IS internal/operational measures as more important than business-oriented measures. This could be due to the fact that a large percentage (67.4 %) of the respondents have more than 10 years of experience in the area of IS. This means that they start from a technical position, and it is therefore, very likely that they are still technically inclined in their thinking.

The results of the t-test which compare the future importance of IS internal/operational against business-oriented measures by IS experience show that those with 10 years and below of IS experience have a higher score for IS internal/operational measures than business-oriented measures. Similarly, those with 10 to 20 years of experience in IS also have a higher IS internal/operational scores than business-oriented scores. However, those with more than 20 years of IS experience seem to place equal importance on the two measures. This seems to point out that those managers who have more experience in IS have developed better management skills to consider that business-oriented measures are more important than IS internal/operational measures or at the very least as important as IS internal/operational measures.

The Effects Of The Length Of Time The Current Position Has Been held

The results show that there are no mediating effects of the length of time the current position of IS managers has been held on the overall IS efficiency and IS effectiveness measures.

However, the length of time the current position of IS managers has been held seems to have a mediating effect on the current importance placed on IS internal/operational and business-oriented measures. Those who have been IS managers for less than 5 years and between 5 and 10 years place more importance on IS internal/operational measures than business-oriented measures, whereas those who have been IS managers for more than 10 years do not show any differences in importance between the two measures. This supports the assumption that those who have been IS managers for a longer time would possess more developed management skills. Therefore, they would consider business-oriented measures as more important than IS internal/operational measures or at the very least, that there are no differences in importance between the two. Another reason for the difference in findings could be that the sample size (for those who have been managers for more than 10 years) is too small in order for the differences in importance placed on the two measures to be significant.

The effects of the length of time respondents have been managers on the future importance of IS internal/operational scores and business-oriented scores in each group show that for the two groups (5 years and below and between 5 and 10 years) the IS internal/operational scores are significantly

higher than business-oriented scores. On the other hand, for those who have been managers for more than 10 years, neither of the measures is higher than the other. They place equal importance in both types of measures. This seems to support the earlier assumption that those who have been IS managers for a longer time would possess more developed management skills. Therefore, they would consider business-oriented measures as more important or at least as important as IS internal/operational measures.

The majority (67.4%) have only held their current positions of IS managers for less than 5 years. It is possible that their managerial skills are still developing. Another explanation for the low duration of time for which they have held their current positions could be that the turnover rate for IS managers is reasonably high. As discovered by Plewa & Lyman (1992), Chief Information Officers (CIOs) usually occupy their positions for an average of 5.9 years, which equates to an average annual turnover of 17%.

The length of time the current position of IS managers has been held seems to have a mediating effect on the current importance of IS internal/operational and financial measures. Those who have been IS managers for less than 5 years and between 5 and 10 years place more importance on IS internal/operational measures than financial measures, whereas those who have been managers for more than 10 years do not show any differences in the importance they place on both measures. The reason behind placing equal importance on the two measures could be that they have become accustomed to incorporating business measures as a reflection of IS performance. Financial measures such as return on investment and comparisons of IS budgets with industry averages are widely used (Saunders

& Jones, 1992; Scudder & Kucic, 1991). Perhaps this is a reason why there are no differences in importance between the two measures for those who have been IS managers for more than 10 years.

The results of study show that there may be a mediating effect of the length of time the current position of IS manager has been held on the current importance of quantitative and qualitative measures. Those who have been IS managers for less than 5 years consider qualitative measures to be more important than quantitative measures. On the other hand, those who have been managers for 5 to 10 years and those with more than 10 years, do not place any difference in importance in the two measures. There is no apparent reason to suggest why this is so. Further research would enlighten this issue.

In the next chapter, the implications of the findings of this study and recommendations for future research will be discussed.

Chapter Eight

CONCLUSION

This chapter presents the implications of the research findings, arising from the testing of the seven research hypotheses, for the IS profession under the sections of IS efficiency and IS effectiveness measures, IS internal/operational and business-oriented measures, IS Internal/operational and financial measures, quantitative and qualitative measures, and the effects of IS management structure and industry sectors on IS effectiveness measures. The directions for possible future research will then be presented.

Implications Of The Findings

The results of this study will have implications on organisations measuring IS performance, particularly IS effectiveness in the areas to be described below.

IS Efficiency and IS Effectiveness Measures

Despite the findings of previous studies, this study still shows that the measures of IS efficiency are currently considered to be as important as IS effectiveness measures. IS efficiency measures are generally easier to produce than IS effectiveness measures. Therefore, these would continually be

used in organisations to reflect IS performance because most IS staff are familiar with it and therefore, it becomes safer to stick to them.

In addition, the structure of IS management plays a role in the importance placed on efficiency measures. Departments with centralised structures usually consider IS efficiency measures to be more important than departments with decentralised structures. IS management structure, therefore, carries important implications for the efficiency of IS.

However, even though these measures of IS efficiency are important, they are still of limited value when addressing the question of the contribution of the enterprise IS to organisational performance as a whole.

IS Internal/Operational and Business-Oriented Measures

IS internal/operational measures will continue to play an important part in reflecting the effectiveness of IS, as shown in this study. They may be considered more important than business-oriented measures, because they are generally known to IS staff. Business-oriented measures, on the other hand, represents an alien concept to many IS staff, because they are more technically trained. The difficulties in grasping these measures may represent a deterrent. In addition, some of these measures have only been developed in recent years, and they are still at the early stage of development. The nature of people is such that they will use a new method only when it has been proven.

IS managers should, therefore, be encouraged to have a positive attitude to the possibilities of using new measures (i.e., business-oriented measures). They should be willing to learn the advantages of these in order that they can communicate better with non-IS managers. They should start viewing the enterprise as a whole, and not simply be focussing on the IS department. In addition, they also need to increase their knowledge of management and the business aspects. With the changing structures of IS management from centralised to decentralised and dispersed, and the growth in importance of the issue of aligning IS with the business, this concept of business-oriented measures becomes much more important. The incorporation of business-oriented measures of IS effectiveness can be achieved by involving business (non-IS) managers in the measurement process. At the same time, IS managers should read and understand the business plans, relate information systems to the plans, in order to be able to define what needs to be measured.

Therefore, even though there are difficulties in assessing information systems at the enterprise level, it is still necessary, because IS managers still have to answer to the Chief Executive Officer's question: What does IS contribute to the bottom line?

IS Internal/Operational and Financial Measures

IS internal/operational measures are currently considered to be more important than financial measures in terms of measuring IS effectiveness. This implies that IS managers are more comfortable with operational measures. It may also indicate that the IS managers find problems or

difficulties with the financial measures. It is possible that a linkage between operational performance measures (such as improved quality and accuracy) and some financial measures (such as improved sales and market share) have not been clearly understood and/or established.

IS Qualitative and Quantitative Measures

Qualitative measures are regarded as more important than quantitative measures because many IS benefits from effective IS systems are intangible. Due to the increased strategic importance of IS to organisations, qualitative measures have appeared to be more important than quantitative measures. This reflects a shift in measurement focus. It may also imply that quantitative measures are becoming inadequate in reflecting IS effectiveness. Previously, many benefits of IS effectiveness were quantitative in nature. However, the recent benefits such as improved customer service, higher product quality and improved communications, are intangible. In order that these benefits are not overlooked when evaluating the effectiveness of IS, particular attention has to be paid on these measures[13].

Even though qualitative measures are more important, it does not necessarily mean that quantitative measures are not important. A balance between the two measures still has to achieved.

IS Effectiveness and IS Management Structures

The study shows that the IS management structure does not affect the importance placed on IS effectiveness measures. Different structures may use the same measures. This has implications to organisations which are changing its structure from centralised to decentralised or dispersed. The same set of measures could be used to reflect the effectiveness of their information systems.

With respect to management of IS resources, it is predicted that there will be decentralisation and eventually dispersion of information resources into business units (Fitzgerald, et al., 1990; Clark, 1992). In a survey of thirty companies in the US, Clark concludes that the size of the central IS function has decreased significantly in the past several years and is predicted to continue to decrease at a faster rate. A majority of the managers who responded encourage the movement of IS resources management towards the direction of decentralisation and dispersion. Therefore, the findings of this study imply that even if there is a shift in IS management, from centralised to decentralised, the measures of IS effectiveness to be used will be similar.

The study, however shows that the structure of IS management affects the importance placed on IS efficiency measures. Those with centralised structures place more emphasis on IS efficiency measures than those with decentralised structures. This, therefore, implies that when an organisation is changing its IS management structure, it is necessary to consider the IS efficiency measures to be used. Moving from a centralised to a centralised

structure will make IS efficiency measures less important as opposed to moving from a decentralised to a centralised IS management structure.

IS Effectiveness and Industry Sectors

There is no evidence of industry sectors affecting the importance placed on IS effectiveness measures used in organisations. This implies that organisations from a specific industry may be using the same measures as organisations in another industry. This provides an advantage in that comparisons of measures in different industries could be made.

Directions For Future Research

Kauffman & Weill (1989) cited in Sethi et al. (1993) suggests that

> IT value research is still in its adolescence and thus the emphasis should be on the theory building: the focus should be on such activities as identifying the appropriate IT variables, delineating their domain and definition, formulating operational measures, and developing a nomological net to understand their relationship with other constructs. The development of exact yardsticks and norm is best deferred to the future. (p. 204)

The question that needs to be asked is how far in the future should we start developing "exact yardsticks and norm"? Sethi says that it may be futile to look for the "best" measures of IT performance in terms of business value,

instead, concentrate on acknowledging all pertinent variables and recognising their strengths and weaknesses.

Business-oriented measures are still new, and there are very little specific guidance on the topic. Therefore, considerable additional research work in this area is still required, in testing these measures for useability, and the understanding of them by IS managers.

Investment in IS resources must be able to be linked with overall organisational effectiveness. Until frameworks which can be shown to be able to integrate IS with the business and measures of effectiveness included with the frameworks are developed, business-oriented measures of IS effectiveness will not increase in importance in the future. It is thus necessary to continue refining and verifying the various frameworks on offer.

With respect to management of IS resources, it is predicted that there will be decentralisation and eventually dispersion of information resources into business units and that the size of the central IS function has decreased significantly in the past several years and is predicted to continue to decrease at a faster rate (Fitzgerald, et al., 1990; Clark, 1992). However, in the sample, the majority (58.1%, see table 10) still has a centralised management structure and may be moving towards decentralisation. Further research in determining the effects of IS management structure on IS effectiveness measures is required. Different IS structures may emphasise on different sets of effectiveness measures.

A more comprehensive research could also be conducted in different industries to determine whether different industries place different degrees of importance to certain IS effectiveness measures. The effects of other mediators on IS effectiveness also warrant further research. The study has demonstrated the potential for negative attitudes of IS managers towards business-oriented measures. Further research could be conducted to ascertain these concerns towards business-oriented measures. The overall problem can be tackled in an easier manner once its component parts are better understood.

In this study, the researcher attempted to determine the importance of business-oriented measures in the future (5 to 10 years from now). It will be interesting to conduct a similar research in five year's time to find out if the results of the research will be the same as what the IS managers have predicted. Will business-oriented measures turn out to be important indicators of IS effectiveness in the future or will IS internal/operational measures remain more important?

Chapter Nine

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FOOTNOTES

[1]Information Systems (IS) can be defined broadly as organisations responsible for supplying computer and communications products and services within an enterprise.

[2]Information Technology (IT), here, is defined broadly to include computers of all types, communication networks, and the integrations of computing and communications technologies.

[3]The term MIS in this study is synonymous with IS.

[4]The term IS in this study includes both IS and IT. IT is a component of IS.

[5]Hubbard (1992) developed performance indicators for facilities managers that showed how the facilities organisation was performing and how it was contributing to the effectiveness of all corporate levels within the organisation. The performance indicators are derived from Kaplan & Norton's (1992) 'the balanced scorecard' model, a framework on which the current study is based on.

[6]Gold (1992) of the Ernst & Young Center for Information Technology & Strategy adopted Kaplan & Norton's (1992) 'the balanced scorecard' model to his measurement project, adapting it to IS measurement by relating the framework to overall IS - business goals. Selected examples of measures used by leading IS organisations are also provided.

[7]Watson's (1989) three-round Delphi study of a sample of IS managers of Australia's top 200 organisations was to get an indication of the most critical information systems management issues facing the IS managers for the next three to five years.

[8]As seen from table 13, an item may appear under more than one variable, for example, "Returns" are categorised as business-oriented, financial and quantitative. However, there is no "overlap" when the hypotheses are tested. In the example above, business-oriented, financial and quantitative are not compared to each other.

[9]Determining the level of alpha can be viewed as follows:

> Studies that deal with vital issues of human health and welfare usually require that the researcher set the level of significance high (.01, .001, or higher). Less concern about the consequences of rejecting the null hypothesis allows the researcher to set the level of significance lower ; for example, .05 is often employed in sociological research (Seaman, 1987, p. 370).

In practice, an alpha of .05 is widely adopted as a suitable standard significance level. In exploratory research, an alpha of .10 is often used, since by increasing alpha we are also increasing the power of the test to discriminate small differences. However, this results in the increase in probability of Type I error. In more rigorous research, an alpha of .01 might be used so that fewer errors will be made when accepting H_1 - but here the test has less power to detect small real differences between the means.

[10]This is the opposite of what the researcher predicted. Previously, it was expected that business oriented measures will be considered more important in the future than IS internal/operational measures. The results appear to show otherwise. A discussion of this finding follows in the next chapter.

[11]The Tukey T method is one of the most widely used classical a posteriori procedures and is recommended for situations in which the researcher is interested only in making all pairwise comparisons of means, provided that the sample sizes are more or less equal. If they are unequal, SYSTAT (the computer package from which all data analyses in this study are conducted) automatically adjusts by a harmonic mean *n*. The confidence interval statements from the Tukey T method are narrower than the corresponding ones obtained by the Scheffe S method (Berenson, et al., 1983, p. 87 and p. 94). Hence the T method yields more powerful results.

[12]This test of analysis of variance is equivalent to the one conducted on hypothesis six. The results are shown again to facilitate a comparison between IS efficiency and IS effectiveness measures.

[13]Parker et al., (1988) devises a method of incorporating these qualitative or intangible benefits to IS effectiveness. It is called Information Economics. It is a comprehensive approach which may help IS managers in assessing the potential value to the organisation of its IS investments.

APPENDIX A

QUESTIONNAIRE, COVER LETTER AND FOLLOW-UP LETTER

SURVEY OF INFORMATION SYSTEMS EFFECTIVENESS MEASURES

DIRECTIONS: Please read each question carefully and circle or tick one appropriate answer. It will take you approximately 15 minutes to complete this questionnaire.

Note: Information Systems (IS) can be defined broadly as a department responsible for supplying computer and communications products and services within an enterprise. Information Technology (IT) is defined broadly to include computers of all types, communication networks, and the integrations of computing and communications technologies. In this survey, the term IS may include IT.

Part I - Organisational Characteristics

1. Which of the following categories is your organisation classified under? (Please tick)

Manufacturers	( )
Wholesale / Retail Trade	( )
Finance, Insurance and Business Services	( )
Agriculture, Forestry, Fishing and Hunting	( )
Mining	( )
Electricity, Gas and Water	( )
Construction	( )
Transport, Storage and Communication	( )
Entertainment and Personal Service	( )
Other: _____	( )

2. What is the structure of the management of your IS department? (Please tick)

Centralised	( )
Decentralised	( )
Other: _____	( )

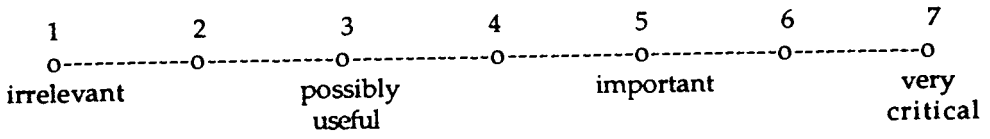
3. What type of IS does the organisation currently use? (Please tick)

Centralised mainframe with terminals	( )
Decentralised mini/micro computers	( )
Centralised mainframe and decentralised mini/micro computers	( )
Wide Area Network	( )
Local Area Network	( )
Other: _____	( )

Part II - Information Systems Performance Measures

Please consider the following **MEASURES** of information systems performance. Evaluate how **IMPORTANT** you feel that each measure is in reflecting IS/IT performance. There are two sets of responses for each question. One set represents **THE CURRENT** time frame and the other represents **THE NEXT 5 TO 10 YEARS.**

A scale of 1 to 7 with each number representing a degree of importance is presented below. ***Circle*** the number for each set (currently and in the next 5 to 10 years) you feel most represents your evaluation of the ***importance*** of each measure listed on the following pages.



EXAMPLE

Currently
1 2 (3) 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 (5) 6 7

1. THROUGHPUT

(a) Hardware: amount of work in millions of instructions per second (MIPs) over a given time period

Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7

(b) Software: number of updates per transaction over a given period of time

Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7

(c) IS Personnel: percentage of activity completed

Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7

2. UTILISATION

(a) Usage of hardware

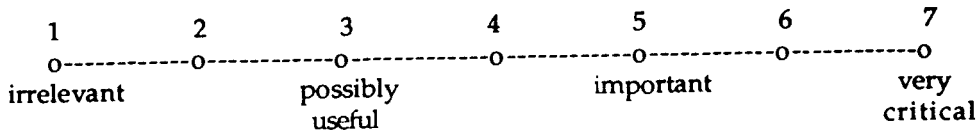
Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7

(b) Usage of software

Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7



(c) Usage of IS personnel

Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7

3. **COST**

(a) Cost of hardware

Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7

(b) Cost of software (purchase & in-house development)

Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7

(c) Cost of IS personnel

Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7

4. **PROGRAMMING**

(a) Lines of correct programming code delivered by IS personnel

Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7

(b) Function points per programming staff per month in IS development or maintenance, (Function points measure the efficiency of personnel by counting system inputs, outputs, files, interfaces and inquiries, weighting them for complexity and adjusting based on system characteristics)

Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7

5. **AVAILABILITY**

(a) Hardware: the percentage of time hardware is operating

Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7

(b) Software: the percentage of time software is operating

Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7

1 2 3 4 5 6 7
o----------o----------o----------o----------o----------o----------o
irrelevant possibly useful important very critical

(c) IS personnel: the percentage of time an employee reports to work

Currently 1 2 3 4 5 6 7 The Next 5 To 10 Years 1 2 3 4 5 6 7

6. **TIMELINESS**

(a) Hardware: response time of hardware

Currently 1 2 3 4 5 6 7 The Next 5 To 10 Years 1 2 3 4 5 6 7

(b) Software: measured by the elapsed time between online request and online response for information

Currently 1 2 3 4 5 6 7 The Next 5 To 10 Years 1 2 3 4 5 6 7

(c) IS personnel: measured by activities finished on time over total assigned activities

Currently 1 2 3 4 5 6 7 The Next 5 To 10 Years 1 2 3 4 5 6 7

7. **ACCURACY OF INFORMATION PERTAINING TO**

(a) Hardware: measured by actual input/output errors over expected input/output errors caused by hardware faults

Currently 1 2 3 4 5 6 7 The Next 5 To 10 Years 1 2 3 4 5 6 7

(b) Software: measured by actual input/output errors over expected input/output errors caused by software defects

Currently 1 2 3 4 5 6 7 The Next 5 To 10 Years 1 2 3 4 5 6 7

(c) User personnel: measured by actual input/output errors over expected input/output errors caused by personnel

Currently 1 2 3 4 5 6 7 The Next 5 To 10 Years 1 2 3 4 5 6 7

```
1          2          3          4          5          6          7
o----------o----------o----------o----------o----------o----------o
irrelevant            possibly              important             very
                      useful                                      critical
```

8. QUALITY

(a) Overall functional quality rating relating to the extent to which user functional requirements are met by IS

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

(b) Number of user/customer complaints regarding IS

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

(c) Improved service level provided by IS

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

(d) Overall satisfaction of user/customer with IS

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

(e) User/customer perception of ease of use of IS

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

(f) Users' perceptions of the degree to which IS is meeting the critical success factors of that part of the organisation

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

9. RETURNS

(a) Return on investment of IS

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

(b) Return on equity attributable to IS

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

```
1          2          3          4          5          6          7
o----------o----------o----------o----------o----------o----------o
irrelevant            possibly              important             very
                      useful                                      critical
```

(c) Return on assets attributable to IS

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

(d) Return on management (value added by IS)

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

(e) IS yield: measured in terms of the actual value delivered to the business against what the business expected the benefits to be, and adjusted for customer satisfaction

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

(f) Overall cost reductions attributable to IS

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

10. INCREASED

(a) Increased earnings per share attributable to IS

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

(b) Increased net income attributable to IS (e.g. from the sale of IT products or services)

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

(c) Increased profit margin attributable to IS

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

(d) Increased market share attributable to IS

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

```
1          2          3          4          5          6          7
o----------o----------o----------o----------o----------o----------o
irrelevant            possibly              important             very
                      useful                                      critical
```

(e) Increased sales attributable to IS

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

11. COMPARISONS

(a) Industry comparison of IS budgets as a percentage of revenue

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

(b) Percentage of IS application delivery resources applied to strategic business areas

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

12. TIME

(a) Time to develop new IS applications

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

(b) Time to adopt new IS methodologies

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

13. IS PERSONNEL

(a) Education/training of IS personnel

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

(b) Personnel morale level within IS

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

(c) IS personnel understanding and agreement with strategic directions of the IS

Currently	The Next 5 To 10 Years
1 2 3 4 5 6 7	1 2 3 4 5 6 7

1 2 3 4 5 6 7

o----------o----------o----------o----------o----------o----------o

irrelevant possibly useful important very critical

14. **IS ENABLES**

(a) Improved communications

Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7

(b) Better decision-making

Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7

(c) Expanded access to information

Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7

(d) Enhanced reporting capabilities

Currently
1 2 3 4 5 6 7

The Next 5 To 10 Years
1 2 3 4 5 6 7

Part III - Demographic Data

Would you kindly answer these additional questions? Please tick the appropriate box or circle the relevant number.

1. What is your age?
   - 30 and below ( )
   - 31 to 40 ( )
   - 41 and over ( )

2. What is your position title? _____

3. How long have you held this current position in your organisation?
   - 5 years and below ( )
   - 5 to 10 years ( )
   - More than 10 years ( )

4. How many years of experience do you have in the area of IS?
   - 10 and below ( )
   - 10 to 20 ( )
   - More than 20 ( )

5. How many employees are there in your area of responsibility?
   - 50 and below ( )
   - 50 to 100 ( )
   - More than 100 ( )

6. How would you rate your organisation's overall IS/IT, given the following scale?

1	2	3	4	5	6	7
complete failure		inadequate		good		very successful

7. How do you feel about completing this questionnaire?

1	2	3	4	5
burden	almost a burden	indifferent	almost enjoyable	enjoyable

If you wish to provide additional comments about the questionnaire, please do so in the spaces below.

_____

_____

_____

_____

Would you also like a comparison of your score with the average score? (Please tick)

Yes ( )
No ( )

If you answered "yes" to the above please fill in your name and address below. Whilst the research data may be published you will not be identified. You may withdraw from the study at any time. You may require authorisation.

Name: _____
Organisation: _____
Address: _____
_____
_____

Please return the completed questionnaire in the enclosed reply paid envelope.

Thank you very much for completing the questionnaire.

COVER LETTER

ON ECU LETTERHEAD

1 September 1993

The Manager
Computer Information Systems
Company name & address

Dear Sir/Madam

SURVEY OF INFORMATION SYSTEMS EFFECTIVENESS MEASURES

The measurement of Information Systems (IS) has posed a challenge to IS managers for many years. Yet organisations are vitally interested in establishing the benefits that IS are providing them.

I am conducting research into this topic and have identified a new approach to measuring IS effectiveness. This approach places a greater emphasis on the business contribution that IS are able to make. The outcome of this study should be of great interest to you as a manager of IS. I am therefore requesting your participation in the study by completing the attached questionnaire.

You can be assured that responses made will be kept confidential and only aggregate data may be published. The survey should not take more than 15 minutes to complete. The questions have been sent to Australia's largest organisations only and I am relying on a good response rate to enhance the validity of the findings. In the questionnaire you are able to indicate whether or not you would like to receive the outcome of the study.

Enclosed herewith is a questionnaire and a postage paid self addressed envelope. If you have specific enquiries about this research, I am contactable on telephone 09-450 4706 (fax 09-481 2000) or you may contact my academic supervisor, Dr. Dieter Fink, Department of Information Systems, Edith Cowan University, on telephone 09-383 8333.

Please return the completed questionnaire by no later than 20 September 1993, if possible. Your contribution to enhancing our knowledge in IS is greatly appreciated.

Yours faithfully

Ms Falantina Tjakra
Masters Student in Business (Information Systems)

FOLLOW-UP LETTER

3 October 1993

The Manager
Computer Information Systems
Company name & address

Dear Sir/Madam

SURVEY OF INFORMATION SYSTEMS EFFECTIVENESS MEASURES

Please refer to my letter dated 3 September 1993. If you have responded, please ignore this letter.

In order to complete my Masters thesis in Information Systems, I will require the assistance of your company. This research will provide a new approach to measuring IS effectiveness, as it places a greater emphasis on the business contribution that IS is able to make. This research will be of great interest to you as a manager of IS.

If you have specific enquiries about this research, I am contactable on telephone 09-450 4706 (Fax 09- 481 2000) or my academic supervisor, Dr Dieter Fink, Department of Information Systems, Edith Cowan University on telephone 09-383 8333.

Please return the original questionnaire by 10 November 1993. Submission made after the previous date of 20 September 1993 is still acceptable. I look forward to your assistance and contribution to IS research.

If you have responded, please ignore this letter.

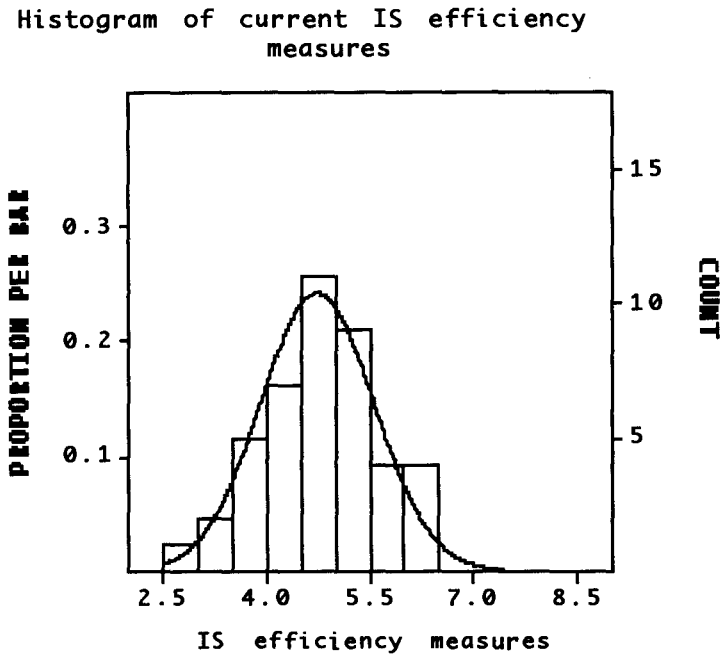
Yours faithfully

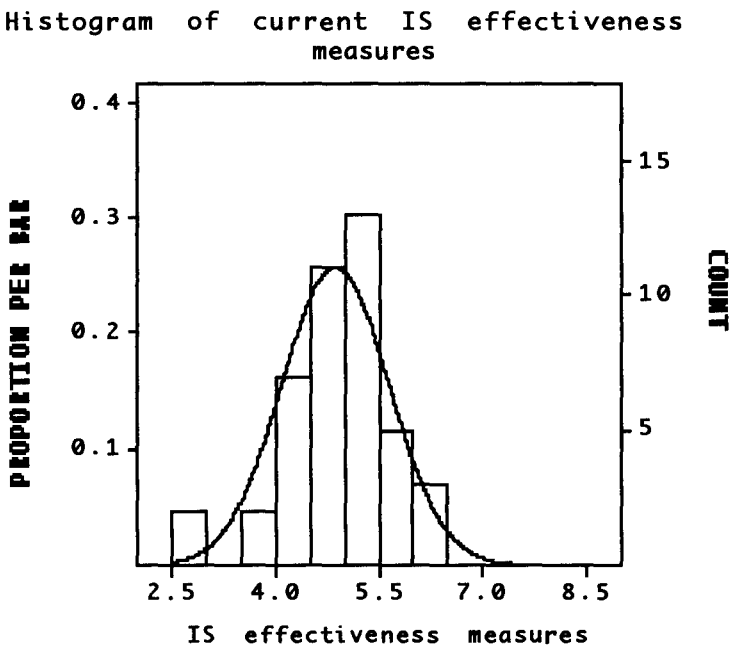
Ms Falantina Tjakra

Masters Student in Business (Information Systems)

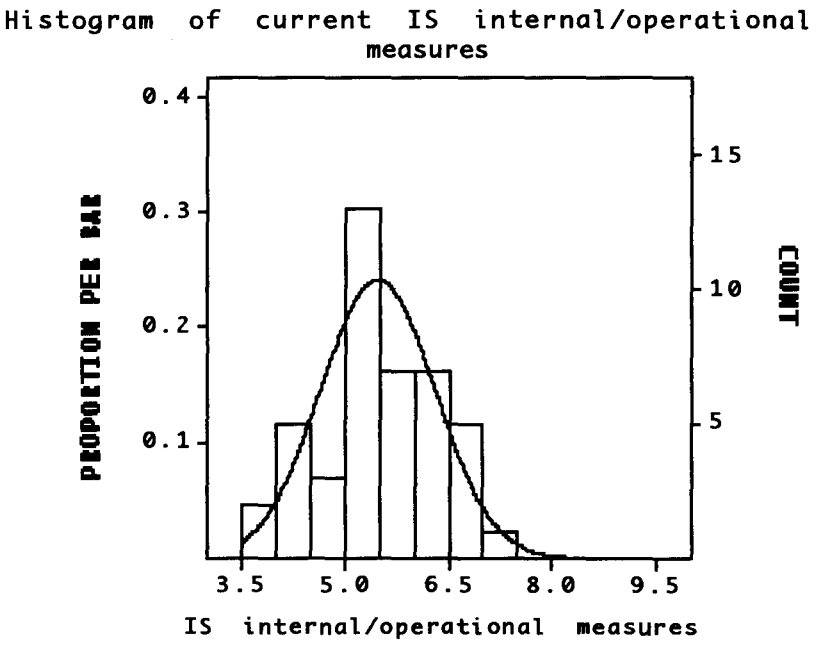
APPENDIX B

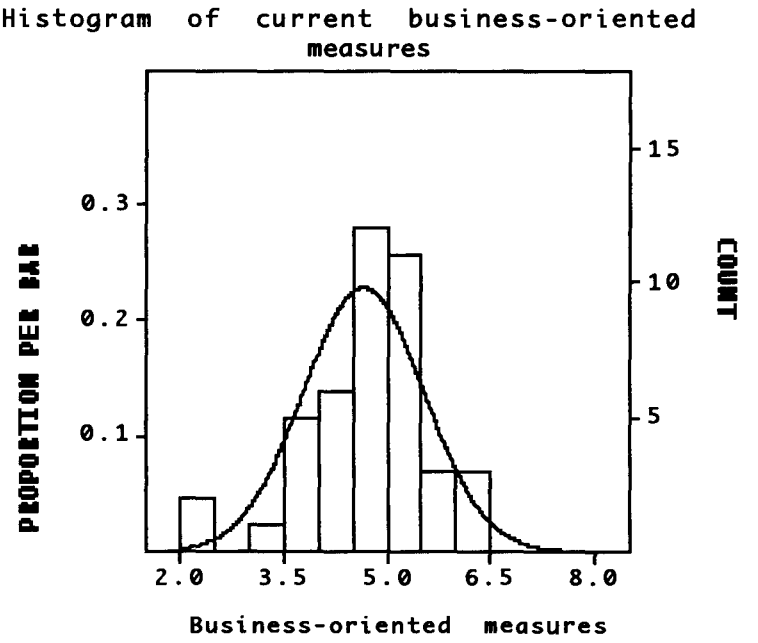
HISTOGRAM OF VARIABLES





HISTOGRAM OF VARIABLES (continued)





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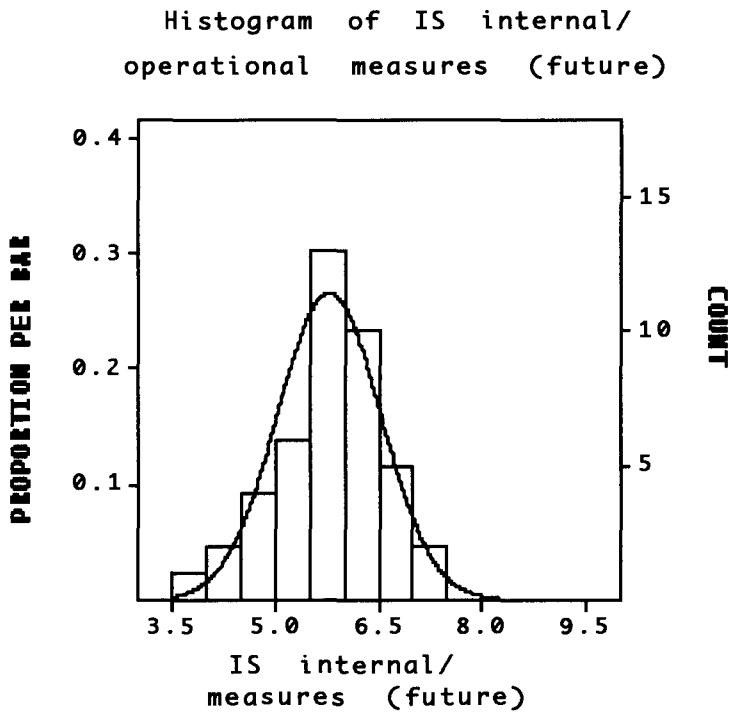

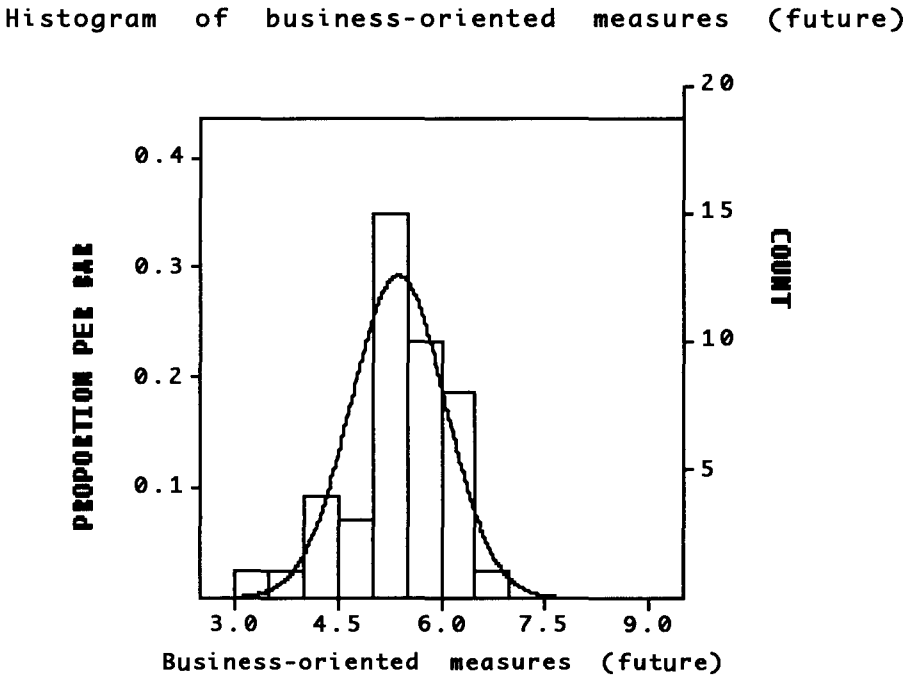

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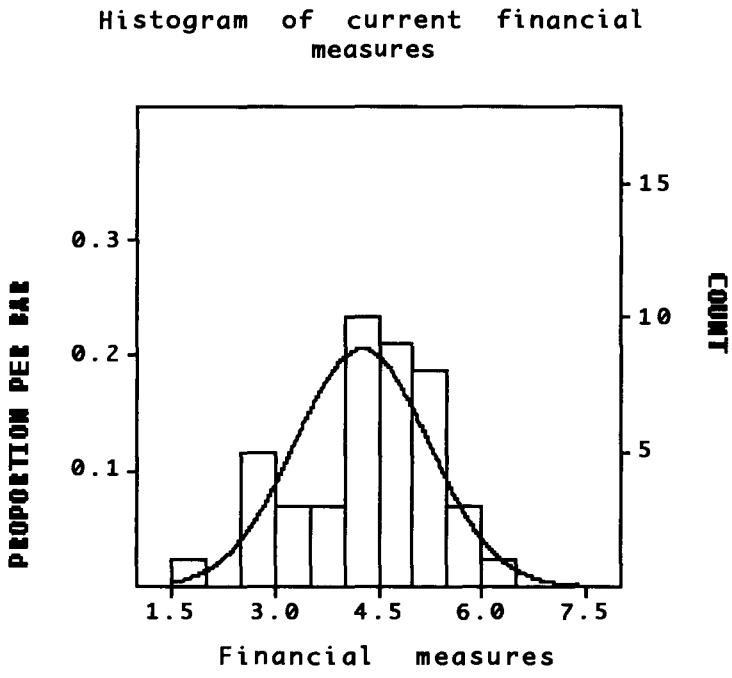

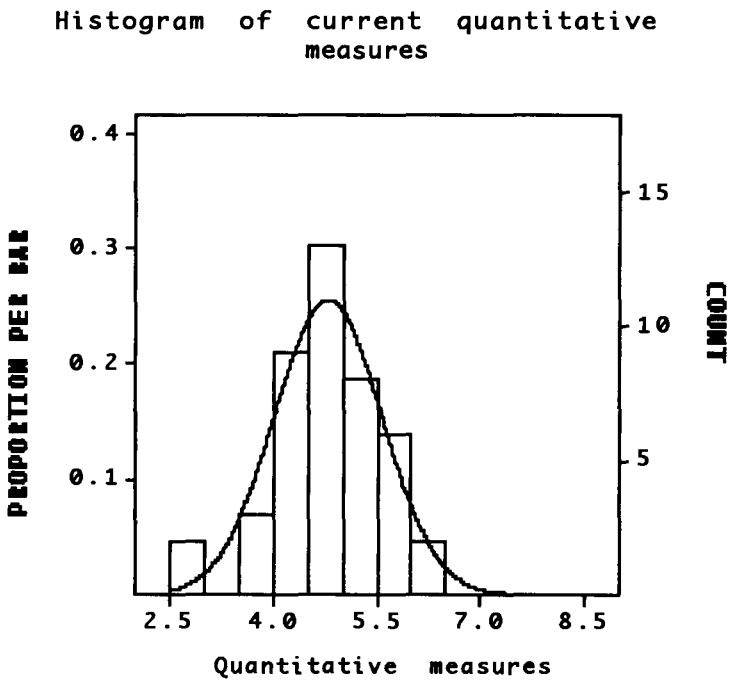

HISTOGRAM OF VARIABLES (continued)